

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
21 November 2002 (21.11.2002)

PCT

(10) International Publication Number  
**WO 02/093403 A1**

(51) International Patent Classification<sup>7</sup>: **G06F 15/173**

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(21) International Application Number: PCT/US02/09178

(22) International Filing Date: 27 March 2002 (27.03.2002)

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(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/279,059 27 March 2001 (27.03.2001) US  
60/311,268 9 August 2001 (09.08.2001) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

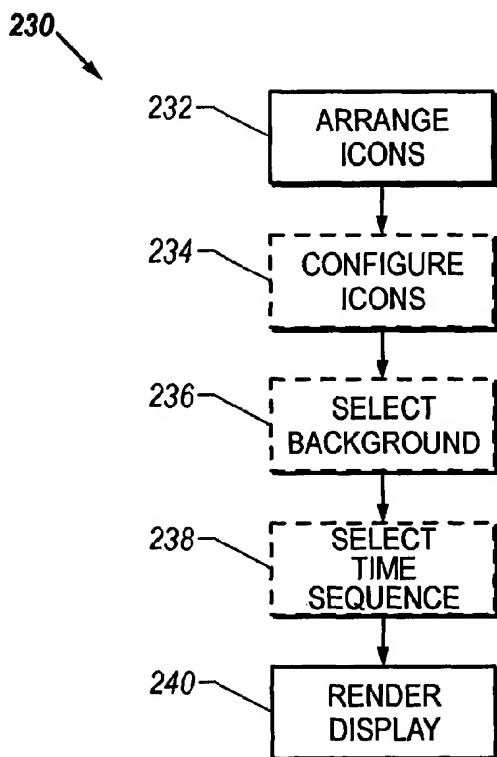
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(84) Designated States (*regional*): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR REPLAY OF HISTORICAL DATA



(57) Abstract: The invention is directed to a system and method for displaying data (240) associated with network appliances. Icons (232) may be configurated (234) in a display area (240) in accordance with a characteristic associated with the network appliances. This characteristic may be related to location, alarm state, sensor value, or others. Further, the icons (232) may display visual indication associated with network appliance parameters. Moreover, the icons may be superimposed on a graphical element (236) (ie. map, blueprint, image, or plot).



WO 02/093403 A1



**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**METHOD AND APPARATUS FOR REPLAY OF HISTORICAL DATA****TECHNICAL FIELD OF THE INVENTION**

This invention relates in general to a method and apparatus for displaying data. More specifically, this invention relates to replaying historical data associated with network appliances.

**RELATED APPLICATIONS**

This application is a continuation-in-part of U.S. patent Application, Serial No. 09/429,504, filed October 27, 1999 entitled: "METHOD AND SYSTEM FOR MONITORING COMPUTER NETWORKS AND EQUIPMENT", and is incorporated herein by reference in its entirety.

This application is a continuation-in-part of U.S. patent Application, Serial No. 10/057,563, filed January 25, 2002 entitled: "METHOD AND SYSTEM FOR A SET OF NETWORK APPLIANCES WHICH CAN BE CONNECTED TO PROVIDE ENHANCED COLLABORATION, SCALABILITY, AND RELIABILITY", which claims priority of U.S. provisional Application No. 60/264,445, filed January 26, 2001 entitled: "METHOD AND SYSTEM FOR A SET OF NETWORK APPLIANCES WHICH CAN BE CONNECTED TO PROVIDE ENHANCED COLLABORATION, SCALABILITY, AND RELIABILITY and is incorporated herein by reference in its entirety.

This application claims priority of U.S. provisional Application, No. 60/279,059, filed March 27, 2001 entitled: "SENSOR PLAYBACK SYSTEM AND METHOD", and is incorporated herein by reference in its entirety.

This application claims priority of U.S. provisional Application, Serial No. 60/311,268, filed August 9, 2001 entitled: "METHODS FOR DISPLAYING PHYSICAL NETWORK TOPOLOGY AND ENVIRONMENTAL STATUS BY LOCATION, ORGANIZATION, OR RESPONSIBLE PARTY", and is incorporated herein by reference in its entirety.

**BACKGROUND OF THE INVENTION:**

Remote monitoring of locations and equipment has become important in many applications. In one example, remote monitoring of networking equipment improves security, prevents equipment failure, and aids in maintaining network operability.

However, many typical systems for monitoring remote locations and equipment suffer from deficiencies associated with displaying and representing data to end-users. End-users are typically limited to a tabular view of values with few visual clues as to the meaning of those values. Further, these views are typically static and only represent a present value.

5 With such systems, alarms may be missed. Further, users may not notice trending values until an alarm or damage has occurred.

In addition, such display methods make analysis of trends and causality difficult. Failure to understand the cause of a failure or alarm may lead to repeated damage and costly equipment failures.

10 As such, many typical monitoring systems suffer from deficiencies in representing data. Many other problems and disadvantages of the prior art will become apparent to one skilled in the art after comparing such prior art with the present invention as described herein.

#### **SUMMARY OF THE INVENTION:**

Aspects of the invention are found in a display apparatus. The display apparatus may  
15 arrange icons associated with network appliances in a display area. These icons may be arranged in accordance with a characteristic of the network appliances. This characteristic may be a sensor value, type or version of network appliance, or physical location, among others. Further, the icon may exhibit one or more visual indications relating to a parameter. The parameter may, for example, be a sensor reading, alarm state, or network appliance status, among others. In  
20 addition, the icon may display alpha-numeric values of associated parameters.

The icons may be superimposed on a graphic element. The graphic element may, for example, be a map, blueprint, image, or plot, among others. For example, the icons may be arranged according to location. The graphical element may be a map to indicate location. Alternately, the location may be a location within a room or building and the graphical element  
25 may be a blueprint of the room or building. In another exemplary embodiment, the graphical element may be a contour plot indicating variances in sensor values throughout a room. Alternately, the graphical element may be a vector plot.

In addition, the display may replay a set of historical data. The display may update the visual appearance of the icons, the arrangement of the icons, and the graphical element, among  
30 others, in response to a progression through the historical data.

Further aspects of the invention may be found in a method for displaying data associated with network appliances. The method may include arranging icons in a display area. These icons may be arranged in accordance with a characteristic of the network appliances. This characteristic may be a sensor value, type or version of network appliance, or physical location, among others. Further, the icon may exhibit one or more visual indications relating to a parameter. The parameter may, for example, be a sensor reading, alarm state, or network appliance status, among others. In addition, the icon may display alpha-numeric values of associated parameters.

The method may also include rendering a graphical element upon which the icons are superimposed. The graphical element may take the form of those embodiments described above, among others. Further, the method may include replaying historical data associated with the network appliances. This replaying may include updating the visual appearance of the icons, the arrangement of the icons, and the graphical element, among others, in response to a progression through the historical data.

As such, a system for displaying data associated with network appliances is described. Other aspects, advantages and novel features of the present invention will become apparent from the detailed description of the invention when considered in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS:**

For a more complete understanding of the present invention and advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings in which like reference numbers indicate like features and wherein:

Figure 1 is a schematic block diagram of a system, according to the invention;

Figure 2A is a schematic block diagram of an exemplary embodiment of the system as seen in Figure 1;

Figure 2B is a schematic block diagram of an exemplary embodiment of the system as seen in Figure 1;

Figure 2C is a schematic block diagram of an exemplary embodiment of the system as seen in Figure 1;

Figure 3 is a block diagram of an exemplary embodiment of a client machine as seen in Figure 1;

Figure 4 is a block diagram of an exemplary embodiment of a server as seen in Figure 1;

Figure 5 is a block diagram of an exemplary embodiment of a network appliance as seen in Figure 1;

Figure 6 is a schematic block diagram of an exemplary embodiment of a map  
5 configuration, according to the invention;

Figure 7A is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 7B is a diagram of an exemplary embodiment of a display, according to the invention;

10 Figure 7C is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 7D is a diagram of an exemplary embodiment of a display, according to the invention;

15 Figure 8A is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 8B is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 8C is a diagram of an exemplary embodiment of a display, according to the invention;

20 Figure 8D is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 9A is a diagram of an exemplary embodiment of a display, according to the invention;

25 Figure 9B is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 10 is a block flow diagram of an exemplary embodiment of a method for use by the system of Figure 1;

Figure 11 is a block flow diagram of an exemplary embodiment of a method for use by the system of Figure 1;

Figure 12A is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 12B is a diagram of an exemplary embodiment of a display, according to the invention;

5        Figure 13A is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 13B is a diagram of an exemplary embodiment of a display, according to the invention;

10       Figure 14 is a diagram of an exemplary embodiment of a display, according to the invention;

Figure 15A is a diagram of an exemplary embodiment of a display, according to the invention; and

Figure 15B is a diagram of an exemplary embodiment of a display, according to the invention.

15       Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT:**

Figure 1 is a schematic block diagram of the system according to the invention. The system 10 has a server, a client 12 and a network appliance 16. The server 14 is connected to one or more network appliances 16 through an interconnected network. The server 14 may function to transfer sensor data from the network appliance 16 and transfer configuration data to the network appliances 16. The server 14 is also connected to a client machine 12. The client machine 12 may access, display and/or manipulate data stored on the server 14. In this manner, the client 12 may remotely monitor network appliances 16 and the client 12 may reconfigure the network appliances 16.

The client 12 may be connected to the server 14 through an interconnected network. Further, the server 14 may be connected to the network appliance 16 through an interconnected network. The interconnected network may take various forms. These forms may include a global network, wide area network, local area network, wireless network, phone systems, and satellite communications systems, among others. Further, these networks and systems may use various method, protocols, and standards, including, among others, ethernet, wireless ethernet,

TCP/IP, HTTP, FTP, SNMP, Blue Tooth, and others. In addition, various security methods may be used in transferring data, including SSL, among others. Further, a user-controlled level of security may be provided. A standard protocol may allow the client and server to be physically located on separate sides of a firewall, adding another level of security to the customer.

5           In addition, the client 12 may acquire instructions for accessing, displaying and manipulating data from the server 14. These instructions may also be transferred by the server from the server 14 on an as needed basis.

          In one exemplary embodiment, the server 14 may communicate with one or more network appliances 16. The one or more network appliances 16 may be located in a server room.  
10       The one or more network appliances 16 may have sensors for sensing environmental conditions and security states of the server room.

          For example, the network appliances 16 may collect data associated with temperature, humidity, door sensors, alarms, power quality, motion detectors and cameras, among others. The network appliances 16 may, for example, communicate with the server 14 through hypertext  
15       transfer protocols. In one exemplary embodiment, the network appliances 16 are connected to an interconnected network, such as a local area network, wide area network, global network, and wireless network, among others. The network may, for example, use a TCP/IP protocol communications method. The network appliances 16 may, for example, communicate with the server 14 using a hypertext transfer protocol.

20           For example, the network appliances 16 may ping a server 14 with an HTTP method communication. The server 14 may respond to that HTTP ping method communication with data associated with the configuration of the network appliance 16. Alternately, the network appliances 16 may use the HTTP method communication to transfer data to the server 14. In one  
25       embodiment, the network appliance 16 may use an HTTP Post method to send information relating to alarms and alerts. Some alarms and/or alerts may have associated image data which may be stored on the server 14. Furthermore, the server may associate the image data with the alert. Alerts delivered via HTTP Posts may allow other appliances to communicate and deliver  
30       information to servers that cannot initiate communications with the Appliances, for example, due to firewalls or intermittent network connectivity. This approach may provide superior reliability, security, and connectivity to conventional SNMP alert delivery.

          The HTTP Post method may also be used to implement periodic posting of data from the network appliance to the server. The end-user may also configure appliances to periodically deliver their sensor data to the present invention, "pushing" the data to the server instead of

having the server “pull” the data from the appliance. This mechanism allows the server to collect and record data from appliances that it is not capable of initiating communications with, such as appliances located behind a fully blocking firewall to inbound network requests. The delivery of this data may be set to require a user-id and password, allowing the present invention to authenticate the delivered data. The same transactions used for communicating the current sensor values and states may be used to verify status. If the delivery of the data is significantly overdue (i.e. by some period of time, or some number of scheduled Posts are missing), the Server will declare the Appliance “offline” or “missing in action”.

In another embodiment, the server 14 may communicate with the network appliance 16 using an HTTP Get call. However, the server 14 and network appliances 16 may use various communications methods. These methods may include file transfer protocol, hypertext transfer protocol, SNMP, among others. Further, the communications may include messages associated with HTML, XML, HTTP post, HTTP get, compressed data, and image data, among others. The communication may occur on intervals. These intervals may be fixed periodically, vary with date or time, be adjustable, or any combination, among others. In addition, timeouts and retries may be configured.

Further, the server may attempt to find network appliances through discovery. For example, the server may attempt to communicate with each possible address in a given IP address range. In addition, it may attempt to communicate with each of a specified set of ports that the user has configured the HTTP servers on their appliances to use.

The ability to schedule a discovery or collect environmental sensor data during a control window makes life easier for network administrators to reduce network management traffic during peak hours. This approach may allow the user to configure which days of the week to scan for their appliances, as well as what time of day to do the scan. This feature may also allows the user to find appliances located at network sites that are only “dialed up” during certain scheduled times of days, without wasting time and effort attempting to discover them when they are not connected to the central site.

The present invention supports an arbitrary number of discovery policies, allowing discovery to be fine-tuned for multiple sites and different customer policies.

The system may also support “discovering” appliances by handling Appliance-initiated HTTP Posts. When an Appliance issues a Post to the Server, the server will determine if the Appliance is one already managed by the Server. If not, the Appliance will be automatically added, either unconditionally or if it meets certain criteria configured by the user (i.e. only

devices on certain subnets, certain models, or matching membership criteria for certain Groups (see 3.9)). The Server's response to the Post may be used to tell the Appliance how often to check-in in the future (if it is accepted) or to not Post again in the future (if it is rejected), among others.

5           The server 14 may communicate with a client machine 12. For example, the client machine 12 and server 14 may be coupled to an interconnected network. The interconnected network may take various forms. These forms may include global networks, local area networks, wide area networks, wireless networks, phone switching networks, and others. Further, these networks may use various protocols, such as TCP/IP.

10           In one exemplary embodiment, the client machine 12 may communicate with the server 14 using hypertext transfer protocols. For example, the client machine 12 may have a web browser that communicates with the server 14. The web browser may be a JAVA enabled browser. For example, a JAVA enabled browser may download an applet from the server 14. The applets may enable the client machine to access, display, and/or manipulate data stored on  
15 the server 14. For example, the client machine 12 may be able to access information associated with sensor data, configuration data, image data, network appliance status, and map configuration data, among others. In one exemplary embodiment, the client machine 12 may query the server using SQL to retrieve the desired data. However, various other methods may be used to retrieve data.

20           The client machine 12 may then display the data in various formats including tables, maps, and graphs, among others. Furthermore, the client 12 may, in one exemplary embodiment, dynamically load JAVA programming object classes for viewing, accessing, and/or manipulating various data. Most of the HTTP replies returned from the server are in plain ASCII text. However there are several situations where binary transfers of Java Objects are far more  
25 efficient. For these scenarios, a Network Class Loader may be implemented so the server can create complex return-objects for the client. Since the client may be relatively small, a mechanism may provide the underlying Object code to the client before it receives the Object itself. The Network Class Loader is that solution. In other words, the client can make a request to the server and receive both an Object containing data, and the code necessary to decode and  
30 execute the returned Object within the client's application environment.

This feature may further enhance the ability of third-party developers (both end-user and ISVs) to extend the present invention, since the definitions of these interfaces and the classes returned can be published without requiring the ISV to include potentially obsolete versions of

the class implementations in their delivered code (since the up-to-date versions will be served to the application from the present invention using the Network Class Loader). For compression purposes, returned objects from the server may utilize the Object serialization standard put forth by Sun Microsystems in the Java Runtime Environment.

5           The client machine 12 may also manipulate and organize data. In one exemplary embodiment, the client machine 12 may establish dynamic groups, organized by chain of command, business infrastructure, or physical location, among others. These groups may be displayed in a tree structure. Further, these groupings may, for example, be implemented using dynamically created queries.

10           However, the client machine may have various embodiments. Furthermore, the client machine may communicate with the server 14 through various protocols. These protocols may include FTP, HTTP, SNMP, among others. In an alternate embodiment, the client machine 12 may contain software. The software may be functional to acquire and load various programming objects and classes. The software may also be written in various languages such as JAVA, C++,  
15   Visual Basic, among others.

          The server 14 may also communicate to the client machine 12 an alert associated with storage capacity. Further, the server 14 may implement automated backup.

          Figure 2A is a schematic block diagram of an exemplary embodiment of the system as seen in Figure 1. The system 30 may have a server 34 connected to an interconnected network  
20   32. In addition, the system 30 may have client machines 36, 38, network appliances 40, 42, or third party appliances 44 connected to a network 32, among others. The server 34 may function to store information associated with the network appliances. This information may include sensor data, configuration data, image data and map configuration files, among others. The data or information may be down loaded by the server 34 from the network appliances 40, 42.  
25   Alternately, the network appliances 40, 42 may transfer data or information to the server 34 through the interconnected network 32.

          Furthermore, the server may acquire data from a third party appliance 44 through the interconnected network 32. A server 34 may store, group and organize the information and data. Further, the server may supply the information to one or more client machines 36, 38, through  
30   the interconnected network 32.

          One or more client machines 36, 38, may communicate with the server 34 through an interconnected network 32. The clients 36, 38 may access data, display, and manipulate data,

among others. Furthermore, the clients 36, 38 may acquire instructions and/or programs associated with accessing the data from the server 34.

However, the server 34, the network appliances 40, 42, the third party appliance 44 and the clients 36, 38 may or may not be connected to the same interconnected network. Moreover,  
5 these elements may be configured separately, together, or in various combinations, among others.

For example, Figure 2B is a schematic block diagram of an exemplary embodiment of the system as seen in Figure 1. The system has a server connected to two interconnected networks 52, 54. The interconnected network 52 also connects to client machines 58, 60, and 62. The  
10 interconnected network 54 may connect to one or more network appliances 64, 66, 68, and/or third party appliances 69. A server 56 may transfer information to and from the one or more appliances 64, 66, 68 and/or the third party appliances 69 through the interconnected network 54. This information may be sensor data, configuration data, and images, among others.

The server 56 may store the information and supply that information to client machines  
15 58, 60, 62. The client machines 58, 60, 62 may, for example, access, display and/or manipulate the data associated with the network appliances 64, 66, 68 and third party appliances 69. Further, the client machines 58, 60, 62 may acquire from the server 56, instructions, objects, classes, and programs, among others, for accessing, displaying and manipulating the data associated with the network appliances 64, 66, 68 and third party appliances 69, as stored on the  
20 server 56.

Further, Figure 2C is a schematic block diagram of a further exemplary embodiment of the system as seen in Figure 1. The system 70 has a server 76. The server 76 may be connected to a network appliance A 84 or optionally connected to a network appliance B 88. Network appliance A 84 and network appliance B 88 may be connected to an interconnected network 74.  
25 In addition, network appliance 86 and a third party appliance 89 may be connected to the interconnected network 74. The server 76 may be connected to the network appliance A 84 through various means. These means may include a global network, wide area network, local area network, wireless network, phone systems, and satellite communications systems, among others. Further, these networks and systems may use various method, protocols, and standards,  
30 including, among others, ethernet, wireless ethernet, TCP/IP, HTTP, FTP, SNMP, Blue Tooth, and others.

In addition, the server 76 may be connected to network appliance B 88 through various means. These means may include a global network, wide area network, local area network,

wireless network, phone systems, and satellite communications systems, among others. Further, these networks and systems may use various method, protocols, and standards, including, among others, ethernet, wireless ethernet, TCP/IP, HTTP, FTP, SNMP, Blue Tooth, and others.

Moreover, the server 76 may be connected to network appliance A 84 and network  
5 appliance B 88 through the same, different, or various combinations, among others, of interconnected communication methods.

In addition, the server 76 may be connected to one or more client machines 78, 80 82 through an interconnected network 72. The client machines 78, 80, 82, may, through the interconnected network 72, access, display, and manipulate data associated with the network  
10 appliances 84, 86, 88 and/or third party appliances 89 as stored on the server 76. Furthermore, the client machines 78, 80, 82 may acquire from the server 76, instructions, objects, and classes, among others, for accessing, displaying and manipulating data as stored on the server 76.

The server 76 may store data associated with the network appliances 84, 86, 88 and third party appliances 89. This information may include sensor data, configuration data, map  
15 configuration data, groupings and associations, accessibility information, and image data, among others. The server, may, for example, communicate with network appliance A 84 to transfer the data. Alternately, the server 76 may communicate with network appliance B 88 to transfer the data. In one exemplary embodiment, network appliance A 84 may act as an intermediate between network appliances 86, 88, third party appliances 89 and the server 76. Network  
20 appliance A 84 may function as an intermediary by storing a directory of data, acting as a proxy, or acting as a data reciprocal, among others.

However, the elements as seen in Figures 2A, 2B and 2C may configured in various combinations, together or separate, among others. As such, various configurations may be envisaged.

25 Figure 3 shows an exemplary embodiment of a client machine as seen in Figure 1. The client machine 110 may have a processor 112, programmable circuitry 114, one or more network interfaces 116, one or more user interfaces 118, and storage mediums 120, among others. A storage mediums 120 may store application data. Further the storage mediums may store downloaded data and information 128. However, the client 110 may have various  
30 configurations. These elements may or may not be included. Further, these elements may be separate, together, or in various combinations, among others.

The processor 112 may function to interpret the instructions and application data. The processor may take various forms. These forms may include CPUs, embedded processors,

JAVA enabled processors, and various computational circuitry, among others. Further, the processor may operate with an operating system such as Windows 95, Windows 98, Windows 2000, Windows ME, Windows NT, Windows CE, Linux, Unix, BSD, MacOS 9.x, MacOS X, Sun OS, PALM, or a Java-based operating system, among others.

5           The programmable circuitry 114 may take various forms. These forms may enable a user to program the client machine 110 using various interfaces such as a keyboard, mouse, network, drive, and handheld circuitry, among others.

          The network interfaces may take various forms. These forms may include various circuitry for communicating through ethernet, wireless ethernet, Blue Tooth, phone lines, and  
10       modems, among others.

          User interfaces may take various forms. These forms may include monitors, keyboards, wireless devices, handheld devices, and a mouse, among others.

          The storage mediums 120 may take various forms. These forms may include hard drives, floppy drives, removable drives, cards, CD-ROM, CD-RW, CD-R, DVD, DVD-R, DVD-RW,  
15       RAM, and flash memory, among others.

          The storage mediums 120 may store various applications 122, applets 126 and or data 128. The client 110 may function, for example, to access, display and manipulate data stored on a server and associated with network appliances. The client may use installed applications to access, display and manipulate the data. Alternately, the client may download applications,  
20       applets, and object classes, among others, to access, display, and/or manipulate the data. Furthermore, the client may use various combinations of installed and downloaded application, applets, object classes, among others.

          The applications, applets, object classes may take various forms. These forms may include internet browsers, stand alone applications, interpreters, libraries, and instruction sets,  
25       among others.

          In one exemplary embodiment, the client may connect to a server through a network interface 116. The client may have a JAVA enabled web browser. The web browser may function to acquire an applet from the server through the network interface 116. The applet may function to enable access to the data, display the data in various forms, and enable manipulation  
30       of the data. The client may manipulate data on the server to alter map configurations, network appliance associations, accessibility and permission information, annotate data associated with events, and network application configuration data, among others.

Further, the applet or applets may also function to permit changing and/or manipulation of configuration data associated with network appliances. For example, one or more parameters associated with one or more network appliances may be changed. A parameter associated with several network appliances may be changed to a same value for each network appliance.

5 Alternately, a single value may be changed associated with a single parameter of a single network appliance. Furthermore, configuration settings may be uploaded to the server for future implementation on the network appliances.

The applet or applets may enable the client machine to display data. For example, the applet or applications may display a map. The map may have icons associated with the network  
10 appliances. Further, these icons may be used to display representations of the data. These icons may also be superimposed on a graphic, image, map or plot, among others. Further, the icons may be arranged according to type, location, alarm state, configuration, parameter value, or organization, among others. Alternately, the applications or applets may display the data as a table. For example, the table may display a current value of a parameter associated with a sensor  
15 on or connected to a network appliance. Alternately, the table may display alarm states associated with network appliances. Further, the table may display configuration parameters and data associated with network appliances. The table may further enable manipulation and changing of the values within the table. Alternately, the data may be displayed in graphical forms. These graphs may additionally offer the ability to chart data associated with one or more  
20 sensors associated with one or more network appliances. However, various other display methods may be envisaged. The applications or applets may also function to dynamically download data objects, classes, program elements, useful for accessing, displaying and/or manipulating new data elements. For example, a network class loader may be implemented in an application or applet such that new data classes may be implemented. These may, for example,  
25 be written in JAVA.

The applications and/or applets may also function to display image data. The image data may, for example, be associated with events, network appliances, and sensor data, among others. The applet or applets may display the image data in association with the events, network appliances, and/or sensor data.

30 In one exemplary embodiment, the client machine 110 may be a personal computer running an operating system such as, for example, Windows 2000. The client machine 110 may, for example, have a browser such as Internet Explorer and be Java enabled. However, various other browsers or application may be used.

In another exemplary embodiment, the client machine may be a handheld device with an operating system such as PALM or WINDOWS CE and be Java enabled. However, various devices may be envisaged. In addition, various operating systems and computer languages may be used.

5           In this manner, a client machine 110 may have fully functional access to information stored on the server and associated with network appliances. Further, the client may function to view, create, and manipulate groupings of network appliances. The client machine 110 may function to establish permissions to groupings.

Figure 4 is a block diagram of an exemplary embodiment of a server as seen in Figure 1.  
10          A server 130 may have a processor 132, programmable circuitry 134, network interfaces 136, and storage mediums 138 and user interfaces 148. A storage medium 138 may hold databases 140, applications 142, instructions 144 and map configuration data 146. However, these element may or may not be included. Further, these elements may be separate, together, or in various combinations, among others.

15           A processor 132 may take various forms. These forms may include CPUs, embedded processors, JAVA enabled processors, and various computational circuitry, among others. Further the processor 132 may operate using an operating system such as Window 2000, Windows NT, Linux, BSD, UNIX, Mac OS X, Mac OS 9.x, or a Java-based operating system, among others.

20           A programmable circuitry 134 may take various forms. These forms may enable a user to program the server 130 using various interfaces such as a keyboard, mouse, network, drive, and handheld circuitry, among others.

            A network interfaces 136 may take various forms. These forms may include various circuitry for communicating through ethernet, wireless ethernet, Blue Tooth, phone lines, and  
25          modems, among others.

            Storage mediums 138 may take various forms. These forms may include hard drives, floppy drives, removable drives, cards, CD-ROM, CD-RW, CD-R, DVD, DVD-R, DVD-RW, RAM, and flash memory, among others.

            The storage mediums 138 may hold databases 140, applications 142, instructions 144 and  
30          map configuration data 146. The databases 140 may take various forms. These forms may include Oracle databases, SQL compatible databases, Jet databases, generic databases, tables, and spreadsheets, among others. The map configuration data 146 may also be stored in a

database 140. The instructions 144 may take various forms. These forms may include compiled code, interpreted code, Java code, Visual Basic code, C++ code, HTML code, PHP code, and Perl, among others.

5 The user interfaces 148 may take various forms. These forms may include monitors, keyboards, wireless devices, handheld devices, and a mouse, among others.

The server may function to download data from network appliances through the network interfaces 136. The data may, for example, be stored in the databases 140. This data may be sensory data, configuration data, image data, among others. Further, the server may include applications and instructions for communicating with the network appliances.

10 A server 130 may also function to communicate with one or more client machines through the network interface or interfaces 136. The server 130 may transfer applications 142 to the client machine. These applications and instructions may enable the client machine 110 to retrieve, display, and/or manipulate data. These applications may also be delivered in parts, classes, or software objects on an as needed basis.

15 In one exemplary embodiment, a client machine may request an application from the server. The server may deliver at least part of the application to the client machine. For example, a browser on the client machine may request a Java applet. The Java applet may enable the client machine to access, display and manipulate data. For example, the applet may enable the client to organize and group network appliance data, develop user groups, change user  
20 access information, display maps, manipulate icons and map features, change network appliance configurations, display alarms, and annotate data, among others. Further, the client machine may store information on the server.

For example, the server may deliver an application enabling the client to access the database and display image data associated with a camera enabled network appliance.

25 Alternately, the server may deliver a part of an application enabling the client to display a table of network appliances and their associated parameters such as a value of a sensor or an alarm state, among others. Further, the server may deliver a part of an application which displays a tree of network appliances associated into groups.

30 The server may also deliver an application and associated map configuration data. The application may enable the client to access and display a map. The map may have icons superimposed on a background image. The icons may represent network appliances or groupings of network appliances. Further, the icons may link to present or historical values of

the network appliances associated with the icons. In addition, an action such as clicking an icon may initiate another display such as another map, table, or graph. The icons may have an appearance indicative of type, capabilities, status, alarm state, present or historical value of a parameter or sensor output, or responsible party, among others. The icons may be arranged in a manner indicative of physical location, type, capabilities, status, alarm state, present or historical value of a parameter or sensor output, or responsible party, among others. Moreover, the background image may be a picture, video image, graph, contour plot, and vector plot, among others. The application may also enable the client machine to manipulate user access data stored on the server. The application may also enable the client machine to store map configuration data on the server 130.

Figure 5 is a block diagram of a network appliance, for use in the system as seen in Figure 1. The network appliance 150 may have a processor 152, a programmable circuitry 154, one or more network interfaces 156, one or more storage mediums 158, and one or more sensors 162, among others. The storage medium 158 may hold data 160, among others. However, these elements may or may not be included. Further, these elements may be separate, together, or in various configurations, among others.

The processor 152 may take various forms. These forms may include CPUs, embedded processors, JAVA enabled processors, and various computational circuitry, among others.

The programmable circuitry 154 may take various forms. These forms may enable a user to program the network appliance 150 using various interfaces such as a keyboard, mouse, network, drive, and handheld circuitry, among others.

The network interfaces may take various forms. These forms may include various circuitry for communicating through ethernet, wireless ethernet, Blue Tooth, phone lines, and modems, among others. Further, the network interface may enable the network appliance to connect to various networks including global networks, LANs, WANs, phone networks, page networks, satellite communication systems, and wireless networks, among others. The network interface may enable communication between the network appliance 150 and a server and/or other network appliances. Further, the network interface may enable the use of various methods, protocols, and standards, included HTTP, FTP, SNMP, TCP/IP, LDAP, and others.

The storage mediums 158 may take various forms. These forms may include hard drives, floppy drives, removable drives, cards, CD-ROM, CD-RW, CD-R, DVD, DVD-R, DVD-RW, RAM, and flash memory, among others. Further, the storage medium may store data associated

with network appliance configuration, sensors, user access, other network appliances, and algorithms, among others.

The sensors 162 may take various forms. These forms may include temperature sensors, pressure sensors, airflow sensors, alarm sensors, dry contact sensors, humidity sensors, cameras, video cameras, infrared cameras, power quality sensors, data traffic sensors, acoustic sensors, and motion sensors, among others.

The network appliance 150 may function to communicate with the server. The communication may, for example, take the form of a ping, an HTTP GET, an HTTP POST, a SNMP message, an email message, or an FTP command, among others. With the communication, the network appliance may upload data, download configuration and/or accessibility settings, download program information, and indicate status. The communication may also use various security protocols and methods. Alternatively, the network appliance 150 may communicate with another network appliance acting as an intermediary between the server and the network appliance 150. As such, the information above may be exchanged between the network appliance 150 and the other network appliance acting as the intermediary. In both cases, the network appliance may deliver data on a schedule, as it is available, in response to a request, in response to an alarm, or in other manners. Further, the data may be formatted in various protocols including HTTP or FTP, among others.

The network appliance 150 may also communicate with other network appliances in a cluster. The cluster of network appliances may use various means for communication including HTTP, SNMP, and FTP, among others. The cluster may also establish relationships, a directory, and share resources, among others.

In one exemplary embodiment, the network appliance may collect image data in response to an open door alarm or motion alarm. The network appliance 150 may then upload the data to a server. The server may then provide the image and the alarm data to a client machine.

In another exemplary embodiment, a client machine may request temperature data from the server, the server may collect the data from the network appliance 150. The server may then forward the data to the client machine.

In a further example, the client machine may alter configuration data. The data may be stored on the server. The network appliance 150 may retrieve the configuration data from the server and adapt.

Turning to methods of displaying and manipulating data, a map configuration may be established and stored on the server. The map configuration may be accessible by various user. In one exemplary embodiment, Figure 6 is a schematic block diagram of a user association for the map configuration. A first user 172 may create a mapping of icons. The icons may be associated with network appliances. These network appliances may be active or passive devices. Further, the icons may be arranged and/or superimposed on a background image. The first user may establish a permission data. The permission data may for example give a second user 176 access to the map data 174. The second user may be given permission to view or edit the map configuration data, or both. Alternately, the first user may give viewing permission or exclude another user 178.

Additionally, the map view may be “locked” or “unlocked”. When “locked”, the icons and objects on the view are not movable, preventing accidental or intentional manipulation of the layout. The privilege of “unlocking” of the map view can be restricted, allowing a map to be created and maintained by one user account, and safely shared with other, less privileged, users.

The icons may take various forms. These visual forms may be indicative of type, alarm status, parameter value, capabilities, and version, among others. For example, an icon may have a shape representative of its capabilities, a color representative of a sensor value, a right hand flag with a label, a top flag with a numerical value. In addition, the flags may change color in response to alarm conditions. However, various changes and uses of visual characteristics can be envisaged to represent various data associated with network appliances. Each icon may have some, all, or none of these features.

The icons may also link to other images, displays, and data. For example, the user, through an action such as, for example, clicking on the icon may display another mapping, a data table, and an icon configuration, among others. Furthermore, the user may manipulate the icon configuration and store the configuration on the server.

Further, the icons may be arranged in a display in accordance with some characteristic. For example they may be arranged according to a sensor value, an alarm state, a physical location, or randomly, among others. Figure 7A is a schematic block diagram of an exemplary embodiment of a map. The icons may be arranged in a display area. For example, icons associated with a user may be viewed. Figure 7B is a schematic block diagram of an exemplary embodiment of a map. As shown, the icons may be arranged according to an alarm state as indicated by a shaded flag. Alternately, the icons may be arranged according to physical location as shown in Figure 7C. For example, the location may be a location within a room, geography, or server rack.

Further, the icons may be superimposed on a map or image indicative of the location. The map or image may change in response to events associated with the network appliances. For example an image representing a room may be replaced with a similar image indicating an open door.

However, the image may be a picture, video image, plot, graph, blueprint, or map, among others.

5 In another example, the icons may be arranged according to network appliance type, as depicted in Figure 7D. The shape of the icon may for example represent the type or version. However, various pairings between visual characteristics and data may be envisaged. These map configurations and associated accessibility information may be stored on the server and accessed by the client.

10 The icons and object displayed on the map view may include both active network devices and passive devices. The ability to add and manipulate the passive devices along with the active network devices may allow the user to accurately represent the physical environment of his equipment rooms, for example. Other exemplary implementations may allow the end-user to import graphical images in a variety of formats (GIF, BMP, JPG, etc) to use as icons customized  
15 for their specific equipment (both active and passive).

In one embodiment, a mapping may be associated with a grouping of network appliances. This grouping may, for example, be related to physical location or topology. In one example, environmental sensor readings may be displayed on the map views as part of the icon. The map view may display a single sensor attribute at a time on each of the active devices supporting the  
20 given sensor. For example, when temperature is selected, each device that supports a temperature sensor has the most current reading of that sensor presented. In conjunction with the physical representation afforded by the map view, this may enable a presentation of the two-dimensional "field" associated with the given sensor. The map view may also allow very rapid selection of different sensors readings via a context menu, allowing a user to quickly cycle  
25 between the values of different sensors without needing to open additional windows. For sensor types that have potentially different units of measurement (degrees C versus degrees F, ft/min versus meters/min), the view appropriately converts all sensor values to the unit of measurement most appropriate to the locale and preferences of the user, even when the data actually supplied by the different devices is natively in different units (degrees C from one device, degrees F from  
30 another).

The map may also use map colorization. Map colorization refers to the ability to use color to represent sensor readings for an environment. This can be as simple as putting the sensor reading of the device on the icon or changing the color of the icon to represent a sensor

threshold range. Also the background of the map surrounding the icons may look like a contour plot to display sensor readings from around the room.

Figure 8A is a diagram of an exemplary embodiment of the display. As seen, icons may be arranged on the display. The arrangement may be indicative of a location in a room, for example. A background image may be a contour plot. For example, the contour plot may indicate temperature in various regions of the room.

The contour plot may be calculated from values associated with the network appliances. For example, the network appliances may be coupled to sensors in various locations. Data from these sensors may be used in determining the contour plot. For example, the contour plot may use an weighting technique based on the value of some of the sensors.

In an alternate example, Figure 8B shows the icons superimposed on a map. However, a blueprint of a room may also be used. Further, Figure 8C shows a vector plot. For example, air flow throughout the room may be represented in a vector plot. However, the vector plot may represent other data. For example, the vector plot may represent sonic data. Further the vector plot may be calculated. For example, the vector plot may be determine using a weighting of data associated with sensors.

In addition, the vector plot may be combined with a contour plot. This combination may show a single measurement type such as temperature or airflow. Alternately, a temperature contour plot may be combined with an airflow vector plot. However, these plots may be combined in various configurations. Further, the plots may be combined with maps, images, and blueprints, among others. Various combinations may be envisaged.

Further, the icons may be associated with groups. For example, the map as shown in Figure 8B may have icons representing groups. Upon selection of a group, the display may change to give detail of the group. For example, the display may switch to appear like Figure 8A.

Figure 8D shows icons superimposed on an image this may be a static image, a video image, a live image, or others. For example, network appliance icons may be superimposed on an image of a rack. The image may be acquired, real time, by another network appliance. The image may change as new images are available. Alternately, the image may change with events, alarms or alerts, among others.

In another exemplary embodiment, Figure 9A shows the icons superimposed on a blueprint or image of a room. Once an event occurs, the background may change to indicate the

event. For example, using a blueprint as seen in Figure 9A, the background may be changed to indicate an door opening event as seen in Figure 9B. However, the background may change with various events and various graphics may be swapped in the background.

In a further exemplary embodiment, a client machine may display a plot in the background. However, the plot may be swapped for a blueprint or image upon an event such as, for example, a door opening.

Another implementation of present invention may include support for a variety of enclosures, such as equipment racks and cabinets, that will allow presentation of multiple devices stacked vertically at the same location. Map Colorization of these enclosures will allow sensor reading to be presented with respect to vertical positioning, as well as horizontal. In addition, the vertical positions will enable the presentation on the standard Map View of sensors values for a given “slice” of the room (i.e. all temperature sensors at the top of the racks, the middle of the racks, or under the raised floor).

Additional use of the feature could allow the presentation of various attributes generated from multiple related sensors in the same enclosure. For example, each rack could be displayed with the temperature delta between the temperature reading of the cool air flowing into the rack versus the exhaust temperature.

The map view may also auto-sort by alarm severity. For example, environmental sensor alarms may be sorted to be displayed at the top of the map, followed by network connectivity alarms, and lastly by devices that are not in alarm state.

The display string for each icon may be user configurable to vertically display a customizable user-friendly “name” for each device. The devices that are red may have environmental sensor alarms, the devices that are yellow may have network connectivity alarms, and the gray devices may be in a normal state. The colors may be user customizable. In the colorized mode, the display string may show the alarm status.

This ordering and representation allows the user to quickly determine which devices need attention, even in a group containing hundreds or thousands of devices, since the user can quickly look at the first devices listed and know which devices need attention. Also, the user can quickly conclude by the fact that the first device listed has no errors that none of the other devices currently do.

Figure 10 is a block flow diagram of an exemplary method for use in the system as seen in Figure 1. The icons may be arranged as seen in a block 202. They may be arranged

automatically by associated group. Alternately, they may be arranged by a user. A user may or may not configure the icons as seen in a block 204. For example, the user may configure the colorization of the icons, the icon response to sensor values, events, and alarms, and the characteristic upon which the arrangement of the icons is determined, among others.

5 In addition, the user may or may not select a background as seen in a block 206. This background may be a map, blueprint, plot, or image, among others. The system may then render the background. The background may be calculated on a server or determined on the client machine. Further, the image may be stored on the server or client machine, among others. Further, configuration data associated with the display may be stored on the client machine or  
10 server, among others.

In one exemplary embodiment, the client machine obtains an application from the server for displaying data associated with a group of network appliance. Icons are arranged in a display area in accordance with location of network appliances in a room. A contour plot background is selected. The contour plot is determined by the client machine and rendered in the display area  
15 such that the icons are superimposed on the contour plot. However, the plot may have been determined at the server. Further, other backgrounds may have been determined.

Figure 11 is a block flow diagram of another exemplary method for use by the system of Figure 1. As seen in Figure 10, the icons may be arranged and configured as seen in the blocks 232 and 234. Further, a background may or may not be selected as seen in a block 236.

20 In the method 230, however, a period of time may be selected for which historical data exists for the associated network appliances. This data may then be rendered by periodically changing the background and/or visual indications of the icons in accordance with subsequent data taken from a sequence of data associated with the time period. In this manner, historical data may be replayed. Alternately, the display may be updated as new data becomes available  
25 from network appliances.

Figure 12A is a diagram of icons superimposed on a contour plot. For example, the plot may represent temperature in a room. Some event or circumstance may alter the temperature throughout the room. For example, a door may open, the sun may shine through a window, or the air conditioner may turn on, among others. Consequently, the temperature may change and  
30 the display may be updated as seen in Figure 12B.

Data associated with network appliances may also be displayed as a graph as seen in Figure 13A. The graph may display the same type of data for several network appliances,

various data from various sensors for the same appliance, or various combinations, among others. The graph may be composed of historical data or may be updated as new data is available. Further, the graph may replay data, changing the graph to represent a next value in a series of values according to an accelerated schedule.

5 To compact the amount of data the server stores overall, a schema may be implemented to only store the changes in the environment. For example, if the system collected data from an Appliance every 10 minutes, and the temperature of the room was constant for over an hour creating a data point for each collection interval may increase the size of the stored data. Instead, only the changes may be recorded so the environment can be played-back to the user in as  
10 efficient a manner as possible. Since most environmental sensors tend to change value slowly and infrequently, this enables a significant reduction in the amount of data stored in the database of the present invention without any loss of resolution and accuracy: storing 100 rows, 1 per minute, indicating the same temperature reported by the same sensor is no more accurate or detailed (but consumes significantly more data) than one row reporting that the sensor was a  
15 given temperature for the 100 minutes between two points in time. This compaction of the recorded sensor data enables significantly more data to be recorded for more appliances for a longer time (estimates are 20-100 times as much as a conventional 1 sample per row schema). Each row may include both a starting timestamp and an ending timestamp, allowing easy creation of SQL queries requesting sensor readings at any given time (i.e. `SELECT * WHERE`  
20 `((START_TIME <= T) AND (END_TIME >= T));` ). Moreover, this method of selecting, retrieving and/or representing data may be used for any representation of data, including the mapping with icons.

The graphs may be depicted based on a time range and a set of particular sensor readings. Allowing more than one appliance to be graphed at a time allows users to physically view the  
25 patters of environmental changes as well as compare one area of a location against another. The graphs themselves may be organized by day, week, month, or for the entire time range provided. These graphs may then be saved as in a graphic format, such as, a JPEG, GIF, or BMP file, among others, for email and/or reports, or can be exported as comma-delimited text to another utility of the users choosing.

30 The graphs may also include markers indicating any alerts associated with the displayed sensor on the selected appliances. These markers may appear on the line graph at the point in time where the alarm was reported or on an axis, among others. Different markers may be used for alarms reporting errors versus alarms reporting the return-to-normal of a previously out-of-

bounds sensor reading. For example, a solid bullet may be used for errors, and an open bullet for return-to-normal alarms. This feature allows a concise and comprehensive view of the history of a given sensor on a set of appliances, both including the recorded data and highlighting the important events associated with that history.

5           Since some environment changes can be radically different than others, the graph view may implement zooming in on a particular set of data points. This provides the user with a more detailed graph of a smaller time range. Just like the other graphs, a zoomed-in graph can then be saved to a graphic format for email or exported as a comma delimited file for use in another application.

10           When the graph zoom is activated, the time and sensor units scales may be appropriately recomputed based on the selected range. In addition, the legend associated with the graph may be reduced to just include those appliances that have sensor data contained within the zoom window, allowing the zoom view to be effectively used to pull detailed information out of a graph containing more lines of data than could typically viewed effectively.

15           Further, the graph may be updated as new data arrives. Alternately, a time sequence of data may be selected. The graph may be periodically changed in accordance with subsequent values in the time sequence of data. For example, Figure 13B shows a time step update of the graph shown in Figure 13A.

20           In addition, data may be displayed and/or manipulated in other formats. For example, Figure 14 shows a display for image data. The display area 230 may show an image. The image may be associated with an event such as, for example, a door sensor, an alarm, or a specified time, among others. The image 136 may be displayed with event data 232 and/or appliance data 234. However, more than one image may be displayed. A series of images may be displayed from a single appliance. Alternately an array of images from several network appliances.

25           Furthermore, the image may be updated as new images are available. This update may be accomplished by periodic requests from the client machine to the server. Alternately, the server may forward data to the client as it arrives. Alternately, a time sequence of images may be displayed. For example, a historical set of images may be chosen for display.

30           In an alternate embodiment, an array of images may be displayed as seen in Figure 15A. These images may take the form of icons. The images may also be updated with new images or replay historical data. Further, the images may be active in that a user behavior such as, for example, a click may enlarge the image or transition to another display mechanism. For

example, Figure 15B shows an enlargement of image 2. Other images in the display may be removed or made smaller, among others.

As such, a system and method for displaying data associated with network appliances is described. In view of the above detailed description of the present invention and associated  
5 drawings, other modifications and variations will now become apparent to those skilled in the art. It should also be apparent that such other modifications and variations may be effected without departing from the spirit and scope of the present invention as set forth in the claims which follow.

**WHAT IS CLAIMED IS:**

- 1           1. A display, the display comprising:  
2           A display area;  
3           a plurality of icons associated with a plurality of network appliances, the plurality of  
4 network appliances associated with a category, the plurality of icons arranged in the display area  
5 in accordance with a characteristic associated with the plurality of network appliances; and  
6           a graphical element, the graphical element displayed in the display area, the plurality of  
7 icons superimposed on the graphical element.
- 1           2. The display of Claim 1 wherein the graphical element is an image.
- 1           3. The display of Claim 1 wherein the graphical element is a video image.
- 1           4. The display of Claim 1 wherein the graphical element is a contour plot.
- 1           5. The display of Claim 4 wherein the contour plot is associated with temperature data.
- 1           6. The display of Claim 4 wherein the contour plot is associated with airflow data..
- 1           7. The display of Claim 1 wherein the graphical element is a vector plot..
- 1           8. The display of Claim 7 wherein the vector plot is associated with airflow data.
- 1           9. The display of Claim 7 wherein the vector plot is associated with sonic energy data..
- 1           10. The display of Claim 1 wherein the characteristic is a parameter value.
- 1           11. The display of Claim 1 wherein the characteristic is a physical location.
- 1           12. The display of Claim 1 wherein the characteristic is an alarm state.

- 1           13. The display of Claim 1 wherein the category is a responsible party.
- 1           14. The display of Claim 1 wherein the category is a location.
- 1           15. The display of Claim 1 wherein the category is an organization.
- 1           16. The display of Claim 1 wherein at least one icon in the plurality of icons is operable  
2 to initiate another display in response to a user action.
- 1           17. A method for displaying data associated with network appliances, the method  
2 comprising:  
3           arranging a plurality of icons in a display area, the plurality of icons being associated  
4 with a plurality of network appliances, the plurality of network appliances being associated with  
5 a category, the plurality of icons arranged in the display area in accordance with a characteristic  
6 associated with the plurality of network appliances; and  
7           rendering a graphical element in the display area, the plurality of icons superimposed on  
8 the graphical element.
- 1           18. The method of Claim 17 wherein the graphical element is an image.
- 1           19. The method of Claim 17 wherein the graphical element is a video image.
- 1           20. The method of Claim 17 wherein the graphical element is a contour plot.
- 1           21. The method of Claim 22 wherein the contour plot is associated with temperature  
2 data.
- 1           22. The method of Claim 22 wherein the contour plot is associated with airflow data.
- 1           23. The method of Claim 17 wherein the graphical element is a vector plot.

1           24. The method of Claim 23 wherein the vector plot is associated with airflow data.

1           25. The method of Claim 23 wherein the vector plot is associated with sonic energy data.

1           26. The method of Claim 17 wherein the characteristic is a parameter value.

1           27. The method of Claim 17 wherein the characteristic is a physical location.

1           28. The method of Claim 17 wherein the characteristic is an alarm state.

1           29. The method of Claim 17 wherein the category is a responsible party.

1           30. The method of Claim 17 wherein the category is a location.

1           31. The method of Claim 17 wherein the category is an organization.

1           32. The method of Claim 17, the method further comprising:

2           initiating another display in response to a user action associated with at least one of the  
3           plurality of icons.

1           33. A method for displaying data associated with a plurality network appliances, the data  
2           comprising a plurality of time sequenced values, each in the plurality of time sequenced values  
3           associated with at least one time, the method comprising:

4           in association with a first time,

5           arranging a plurality of icons in a display area, the plurality of icons being associated  
6           with the plurality of network appliances, the plurality of network appliances being associated  
7           with a category, the plurality of icons arranged in the display area in accordance with a  
8           characteristic associated with the plurality of network appliances;

9           rendering a graphical element in the display area, the plurality of icons superimposed on  
10          the graphical element, the graphical element having a visual characteristic associated with the  
11          first time; and

12           for a subsequent time,  
13           rendering the graphical element in the display area, the plurality of icons superimposed  
14 on the graphical element, the graphical element having a changed characteristic associated with  
15 the subsequent time.

1           34. The method of Claim 33 wherein the graphical element is an image.

1           35. The method of Claim 33 wherein the graphical element is a video image.

1           36. The method of Claim 33 wherein the graphical element is a contour plot.

1           37. The method of Claim 36 wherein the contour plot is associated with temperature  
2 data.

1           38. The method of Claim 36 wherein the contour plot is associated with airflow data.

1           39. The method of Claim 33 wherein the graphical element is a vector plot.

1           40. The method of Claim 39 wherein the vector plot is associated with airflow data.

1           41. The method of Claim 39 wherein the vector plot is associated with sonic energy data.

1           42. The method of Claim 33 wherein the characteristic is a parameter value.

1           43. The method of Claim 33 wherein the characteristic is a physical location.

1           44. The method of Claim 33 wherein the characteristic is an alarm state.

1           45. The method of Claim 33 wherein the category is a responsible party.

1           46. The method of Claim 33 wherein the category is a location.

1           47. The method of Claim 33 wherein the category is an organization.

1           48. The method of Claim 33, the method further comprising:

2           initiating another display in response to a user action associated with at least one of the  
3 plurality of icons.

1           49. The method of Claim 33 wherein, for the first time, each icon in the plurality of icons  
2 has at least one visual characteristic associated the first time and, for the subsequent time, each  
3 icon in the plurality of icons has at least one changed visual characteristic associated with the  
4 subsequent time.

1/16

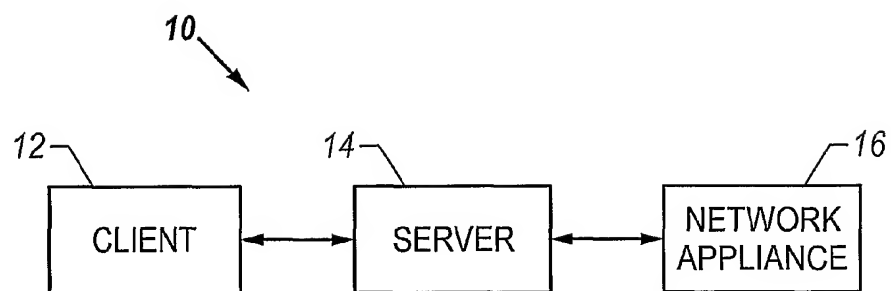


FIG. 1

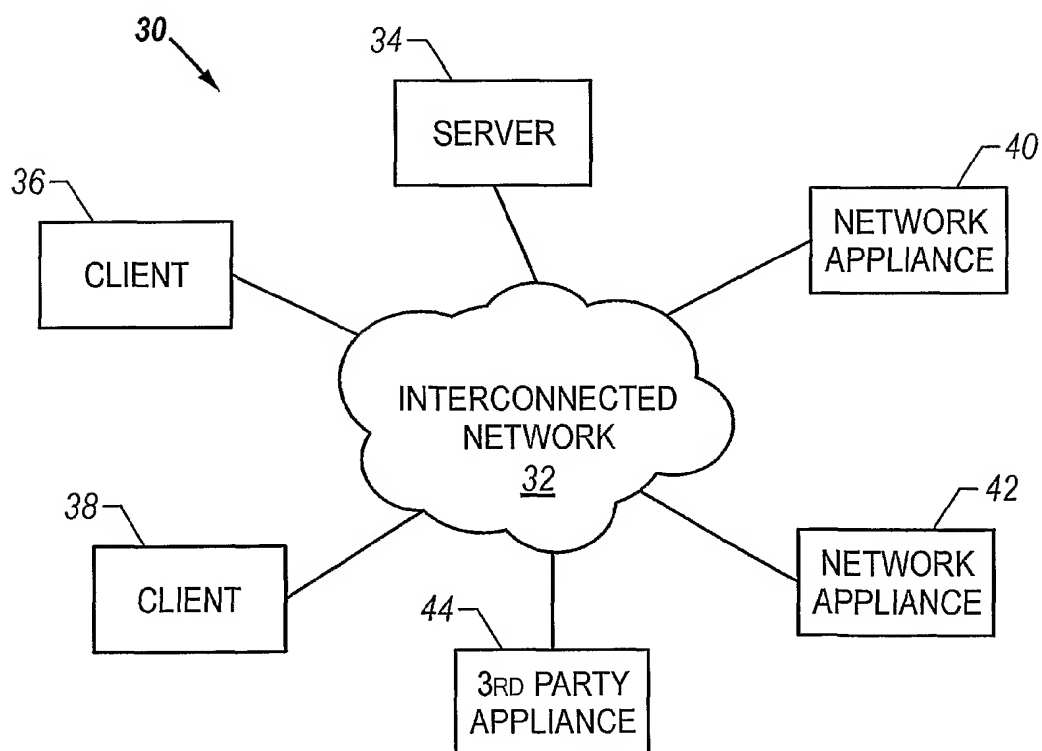


FIG. 2A

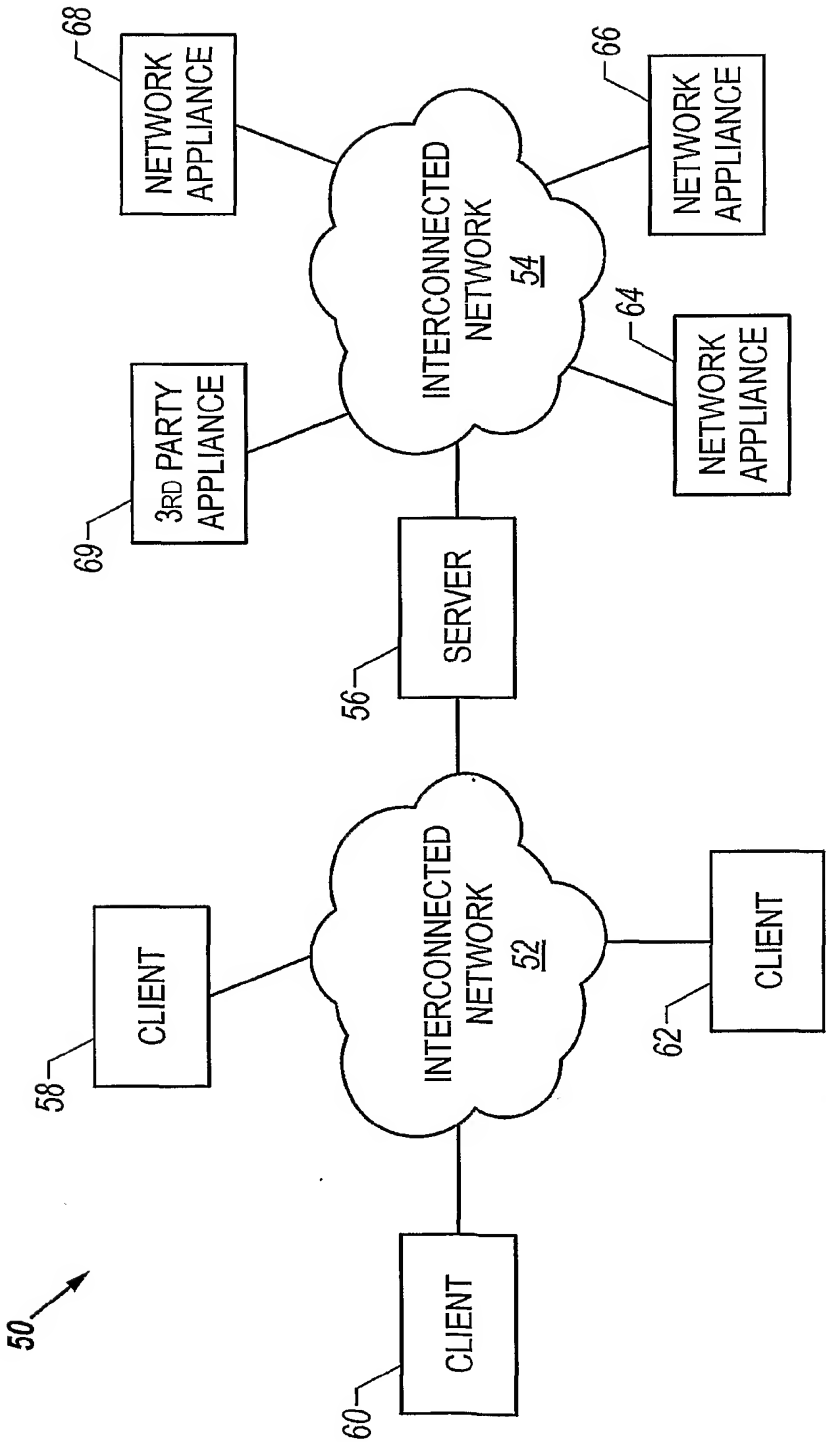


FIG. 2B

3/16

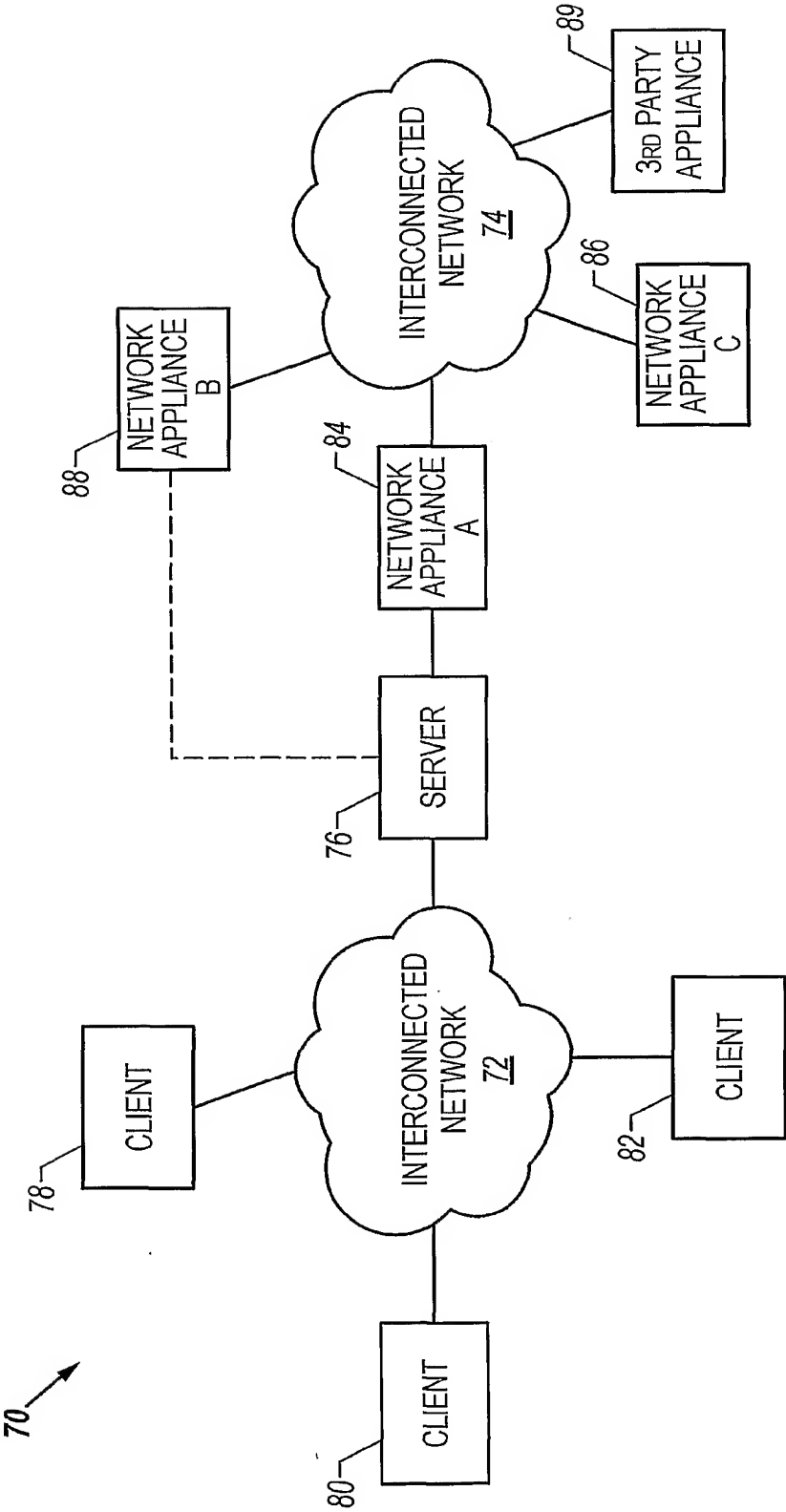


FIG. 2C

4/16

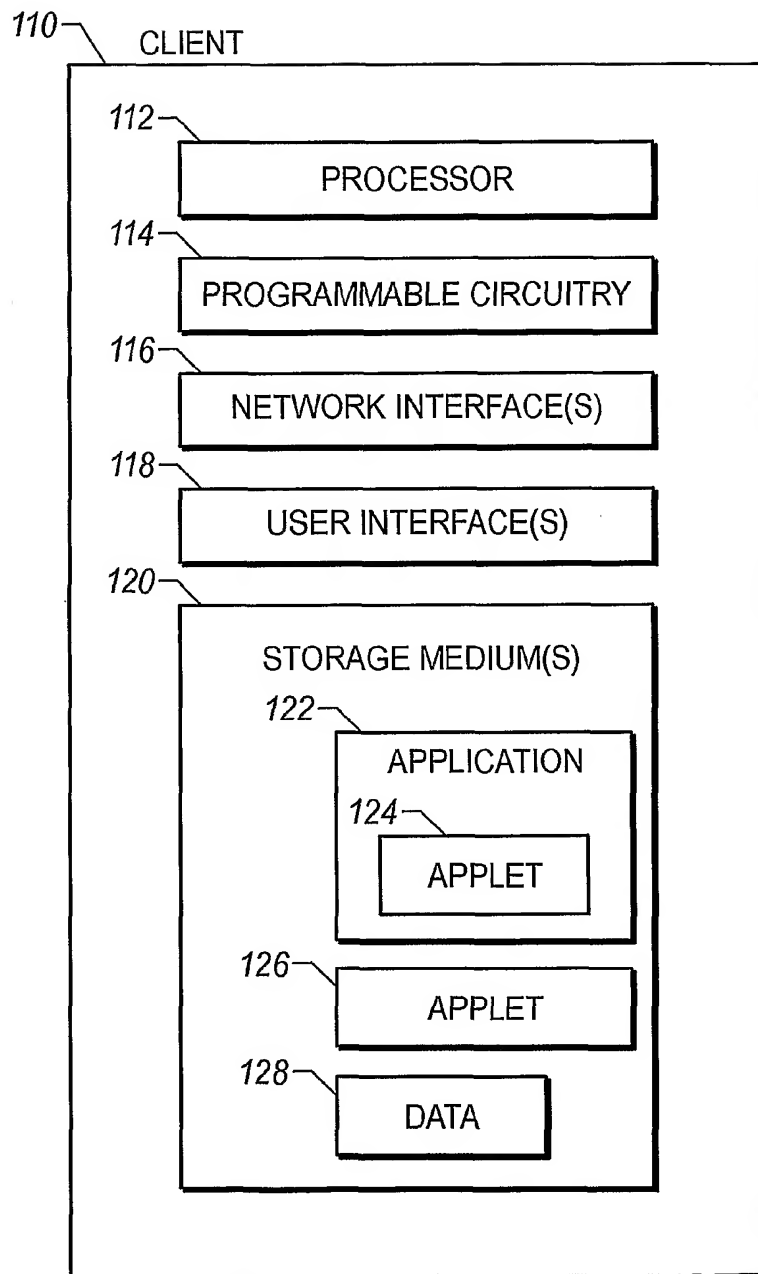


FIG. 3

5/16

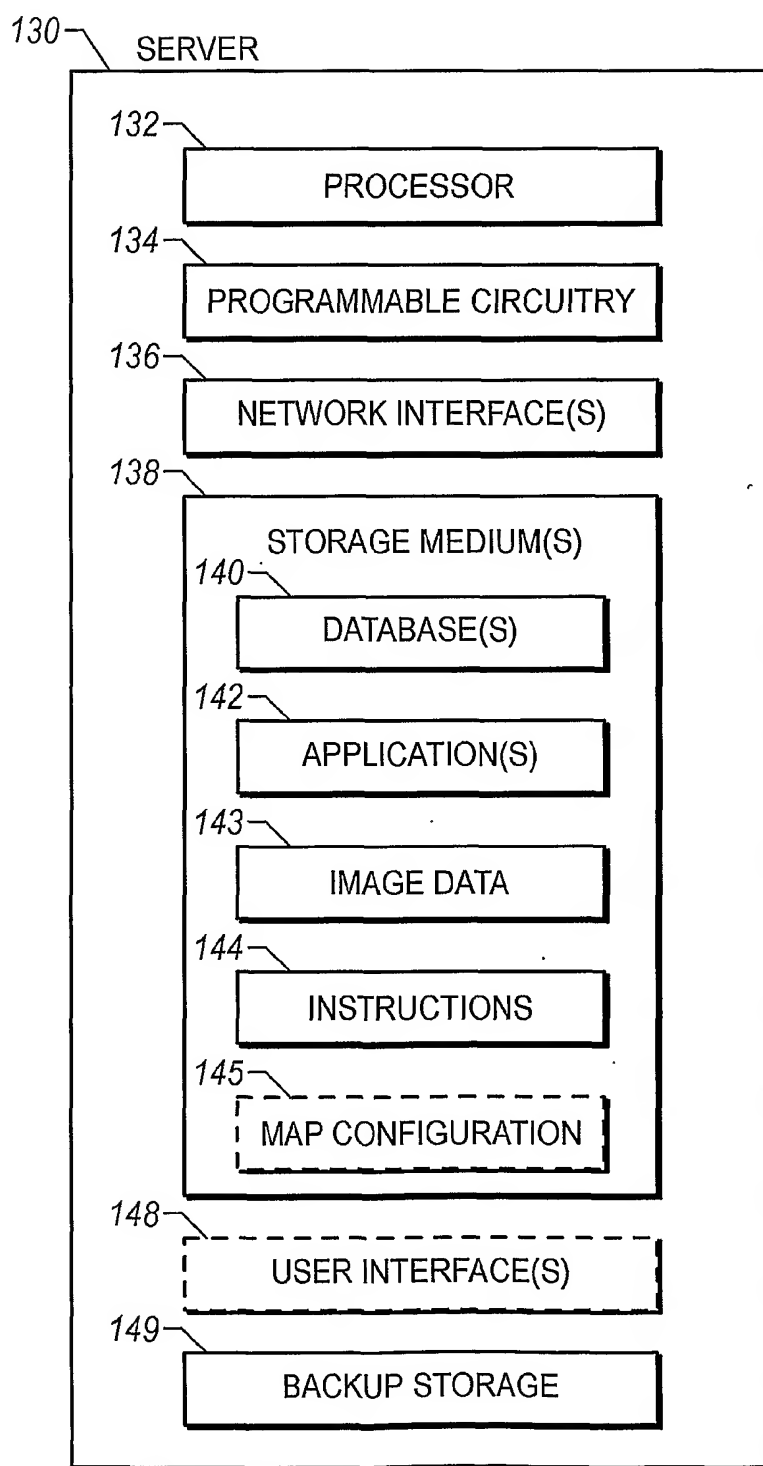


FIG. 4

6/16

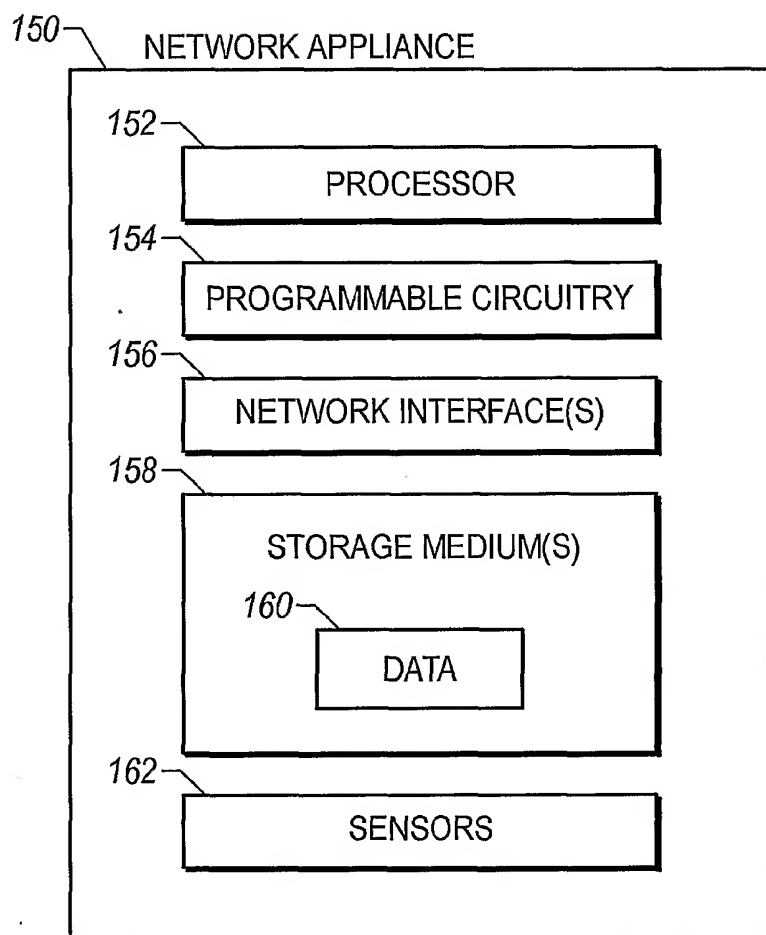


FIG. 5

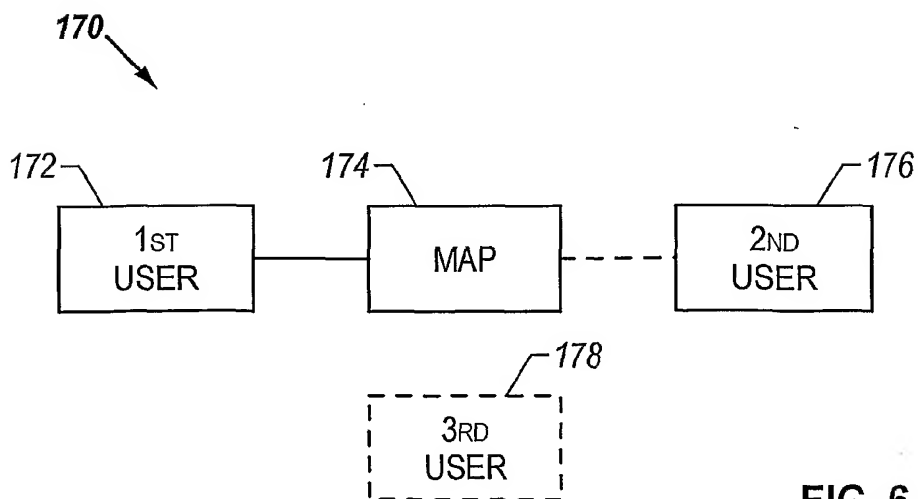


FIG. 6

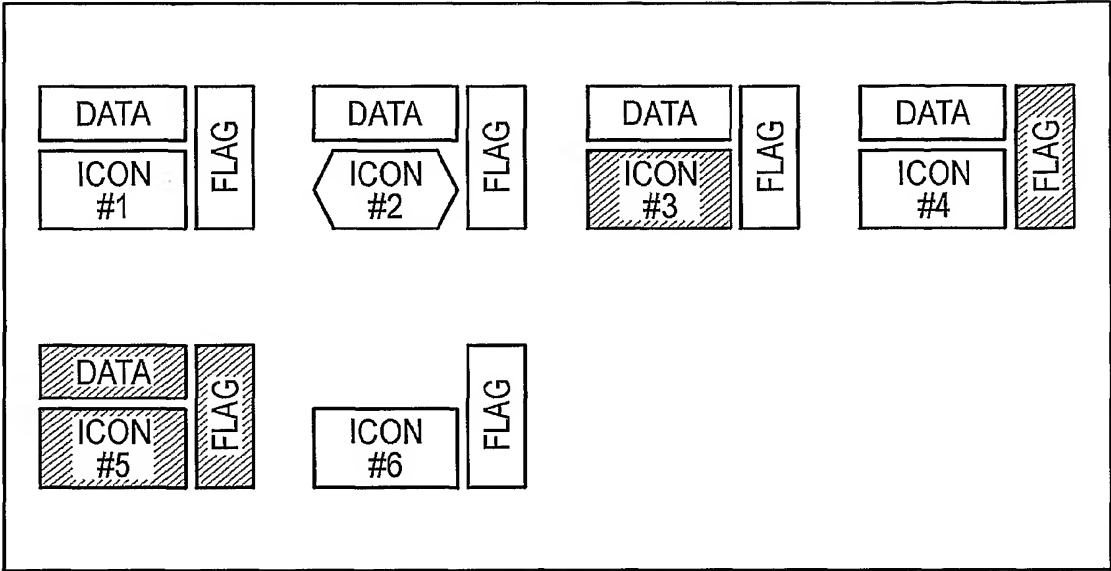


FIG. 7A

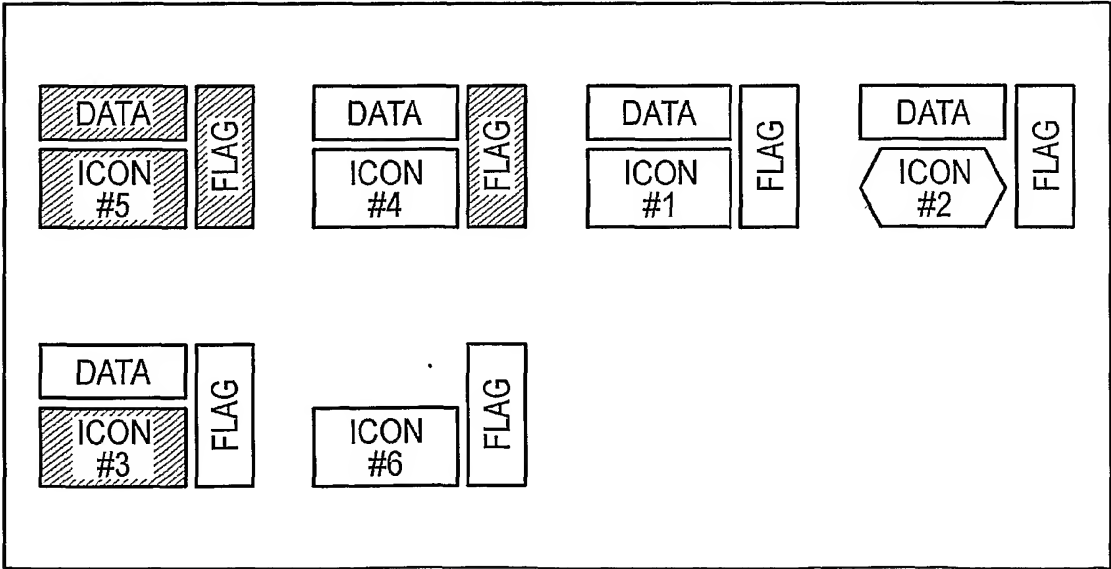


FIG. 7B

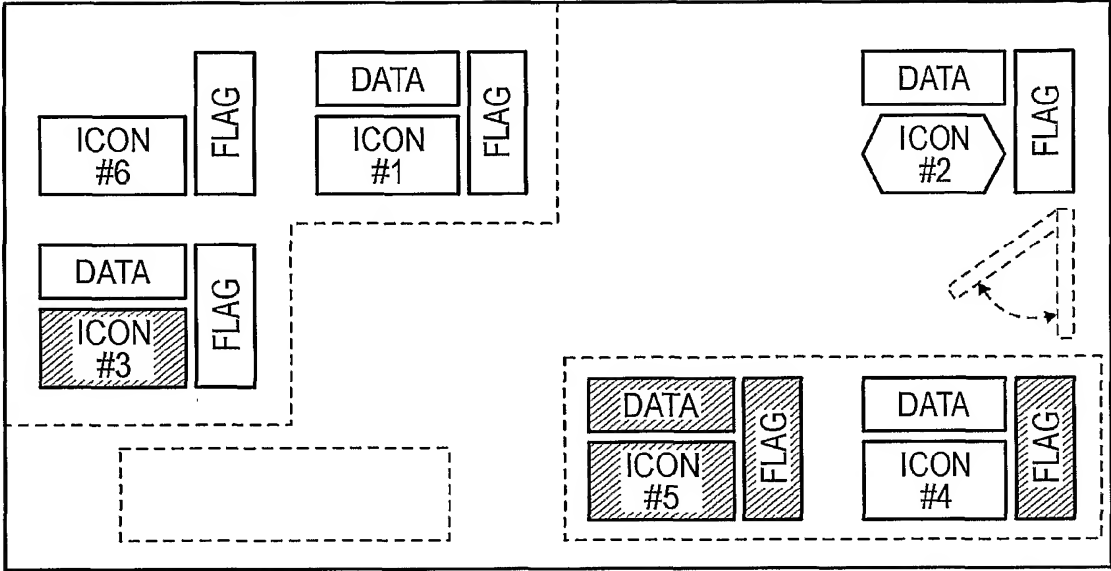


FIG. 7C

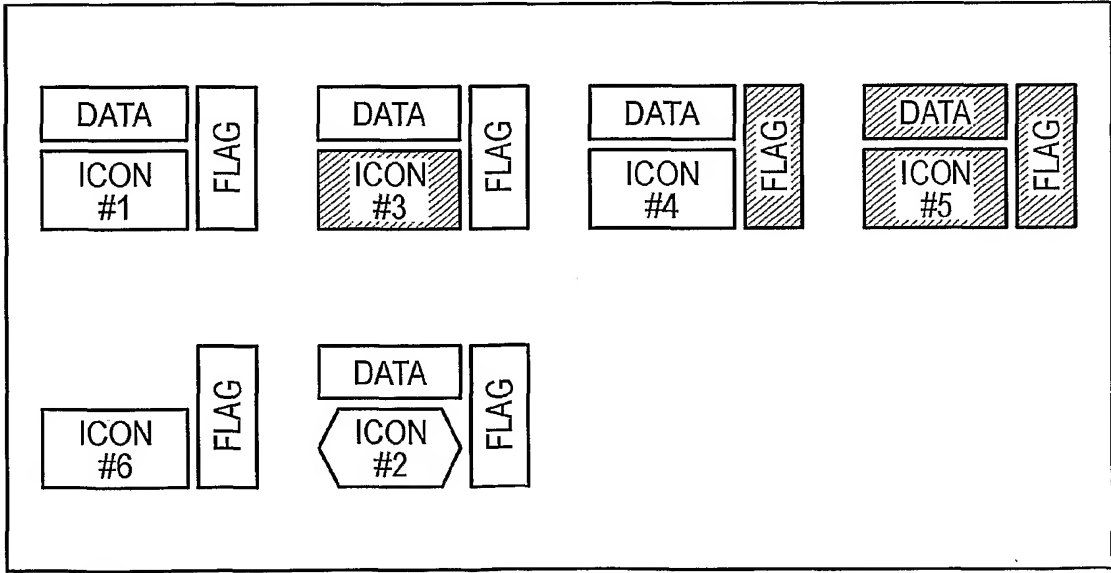


FIG. 7D

9/16

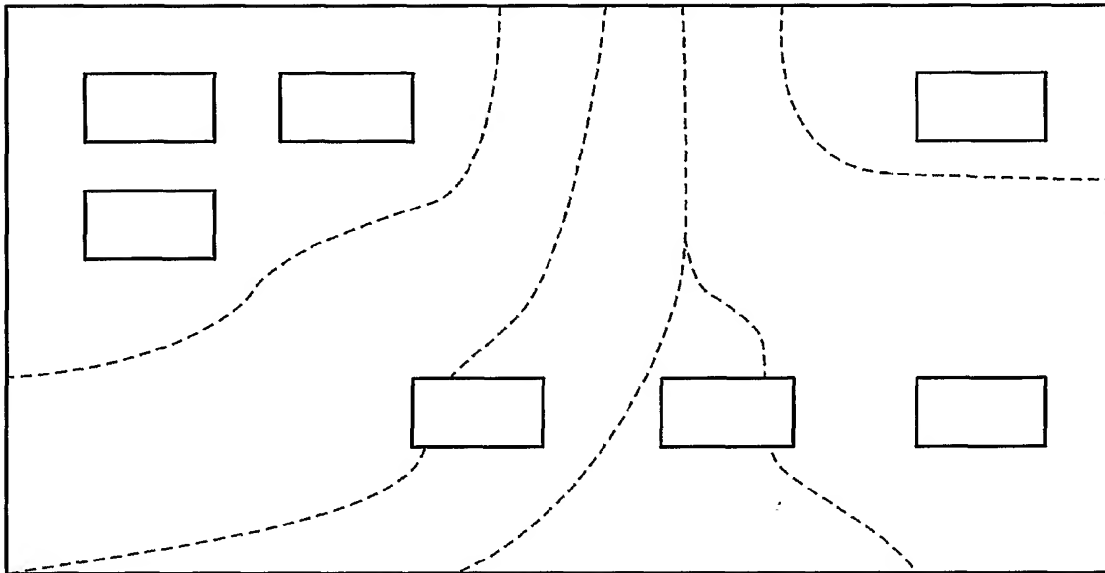


FIG. 8A

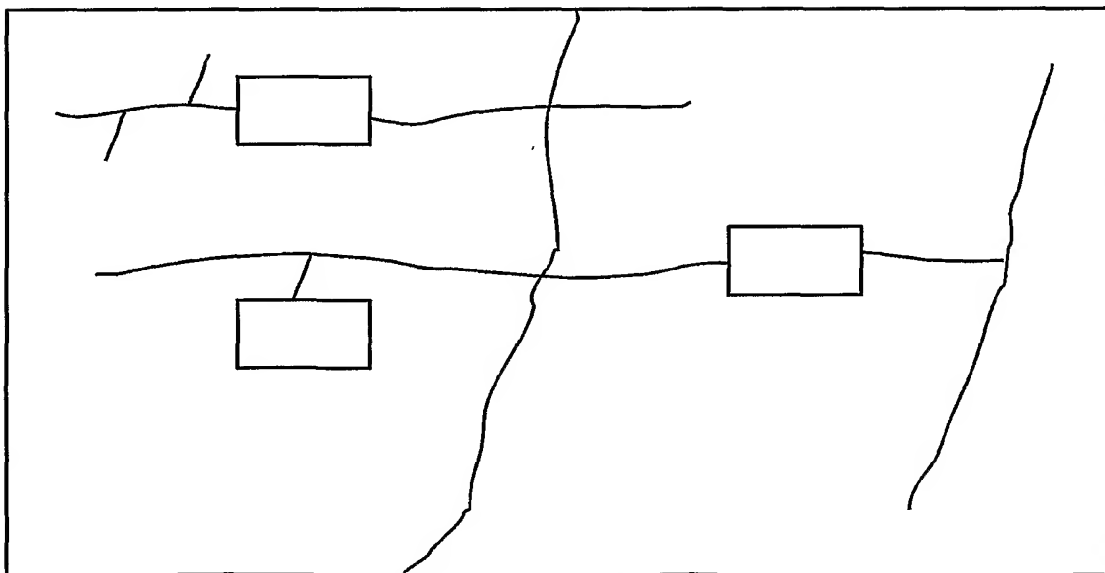


FIG. 8B

10/16

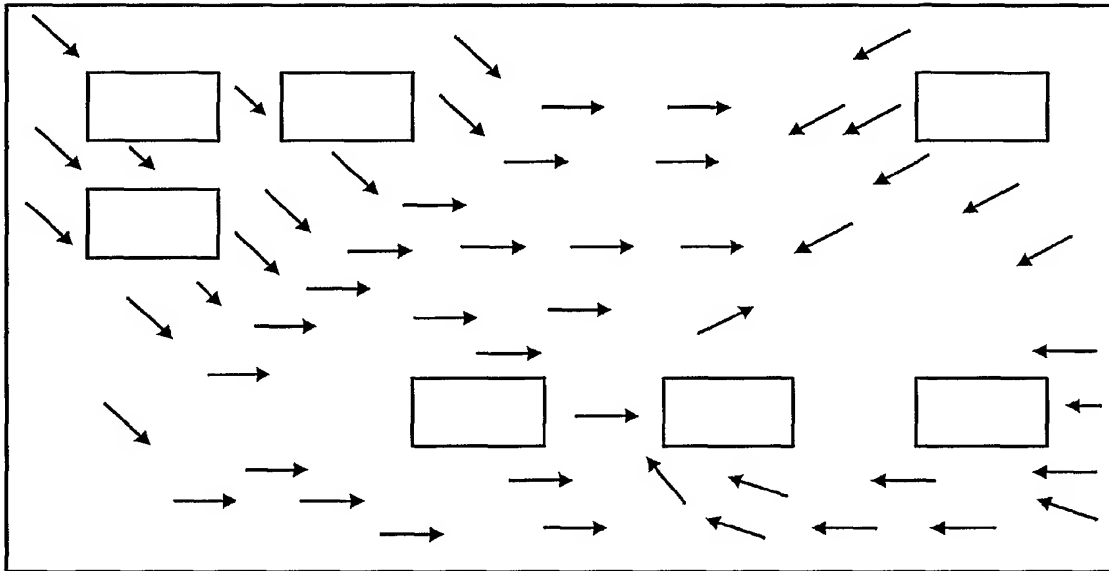


FIG. 8C

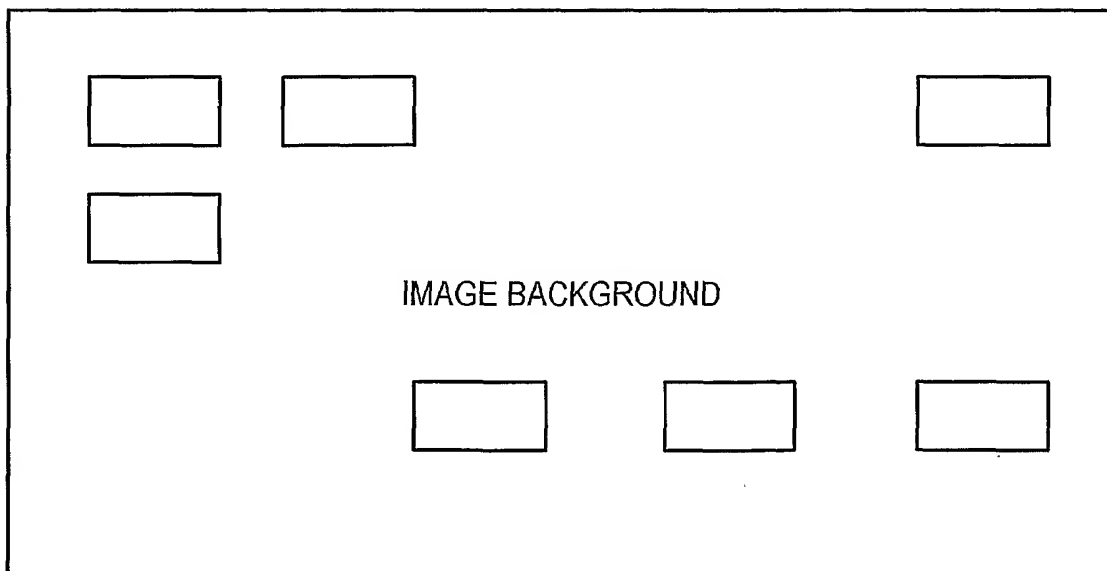


FIG. 8D

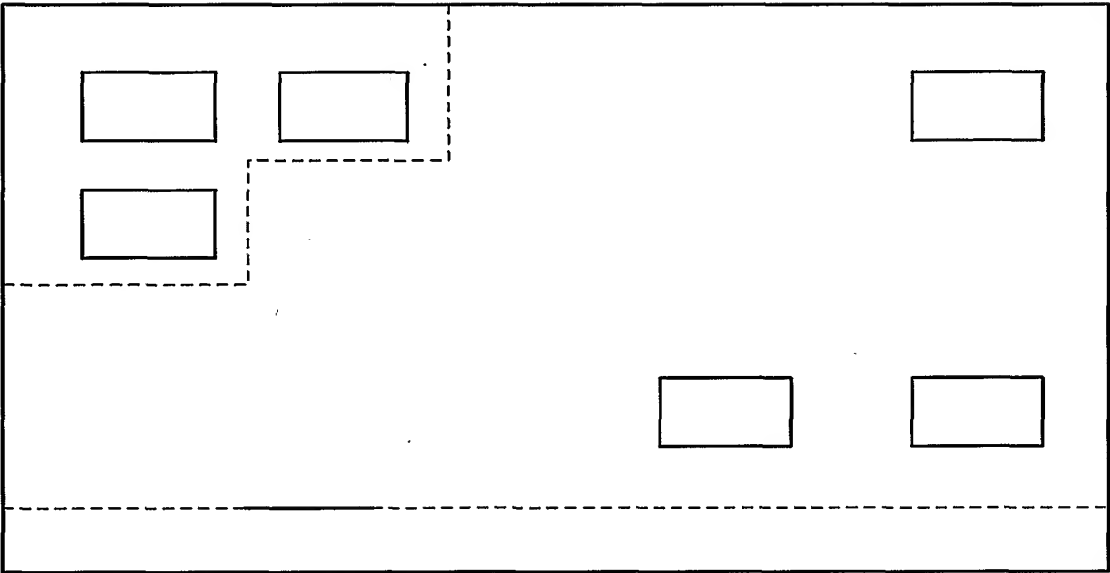


FIG. 9A

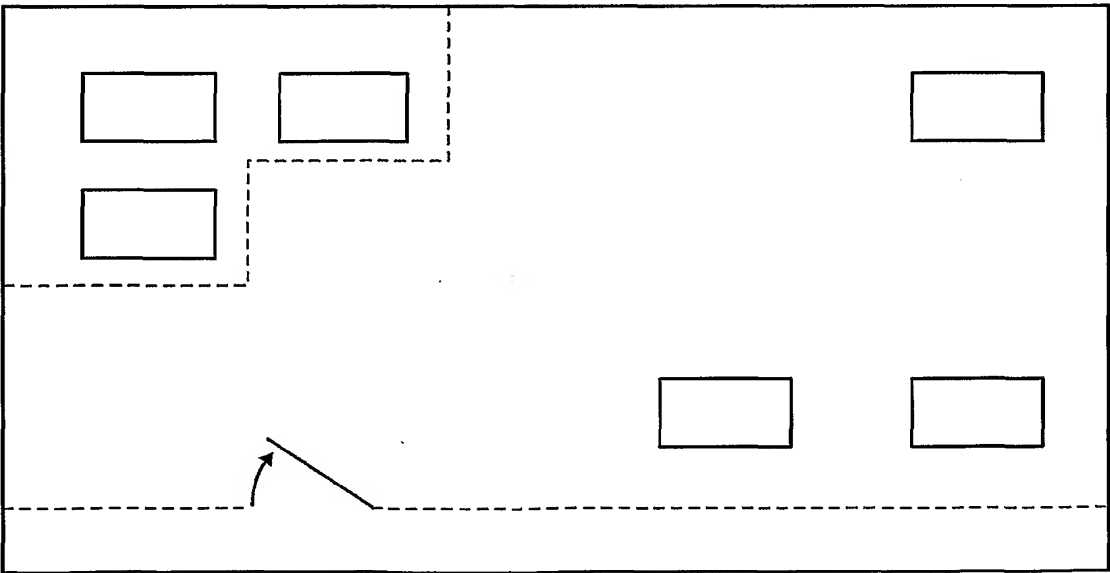


FIG. 9B

12/16

200

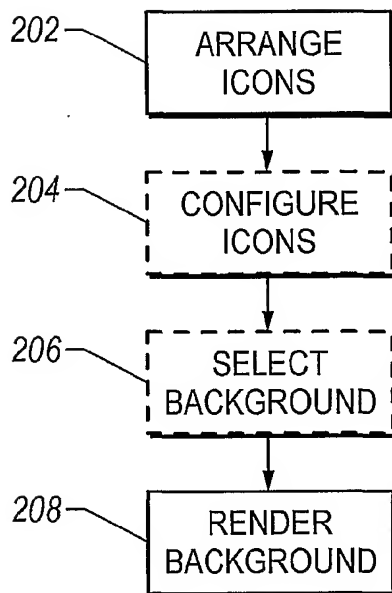


FIG. 10

230

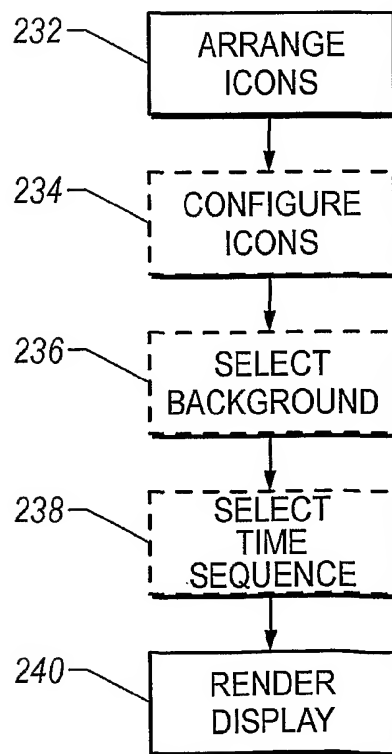


FIG. 11

13/16

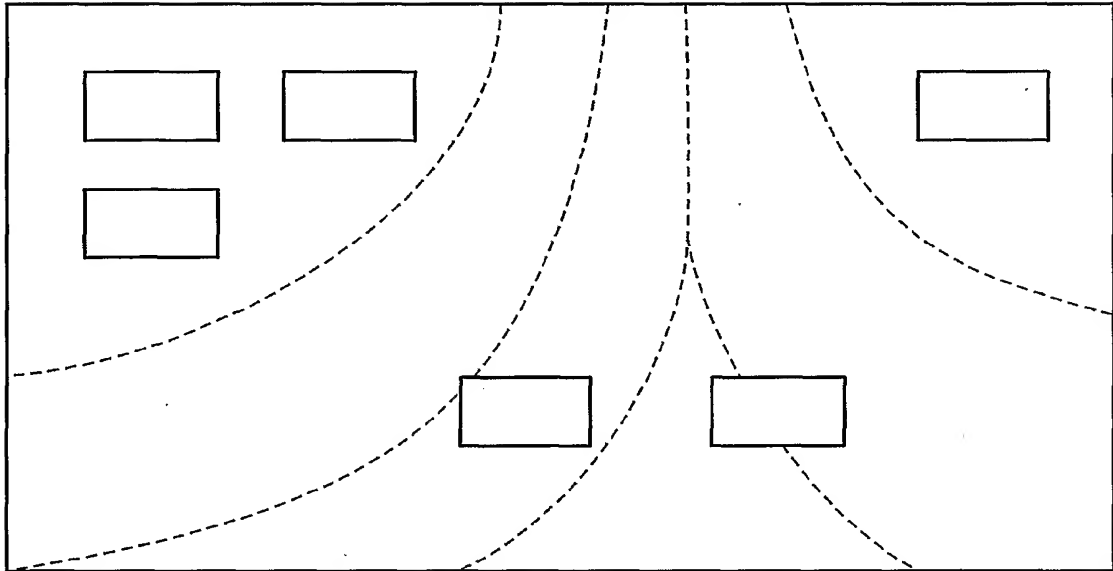


FIG. 12A

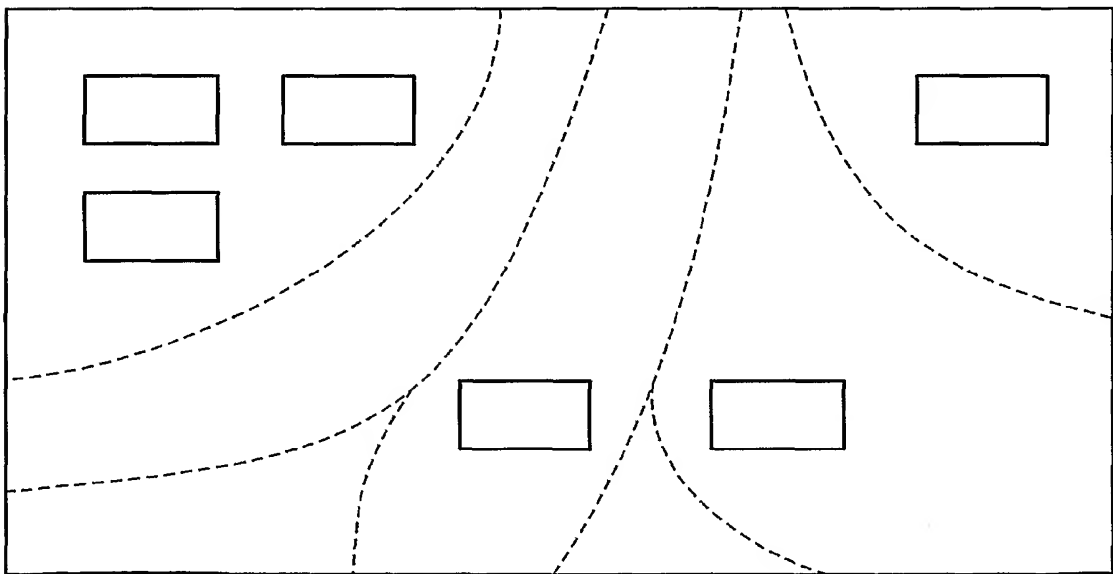


FIG. 12B

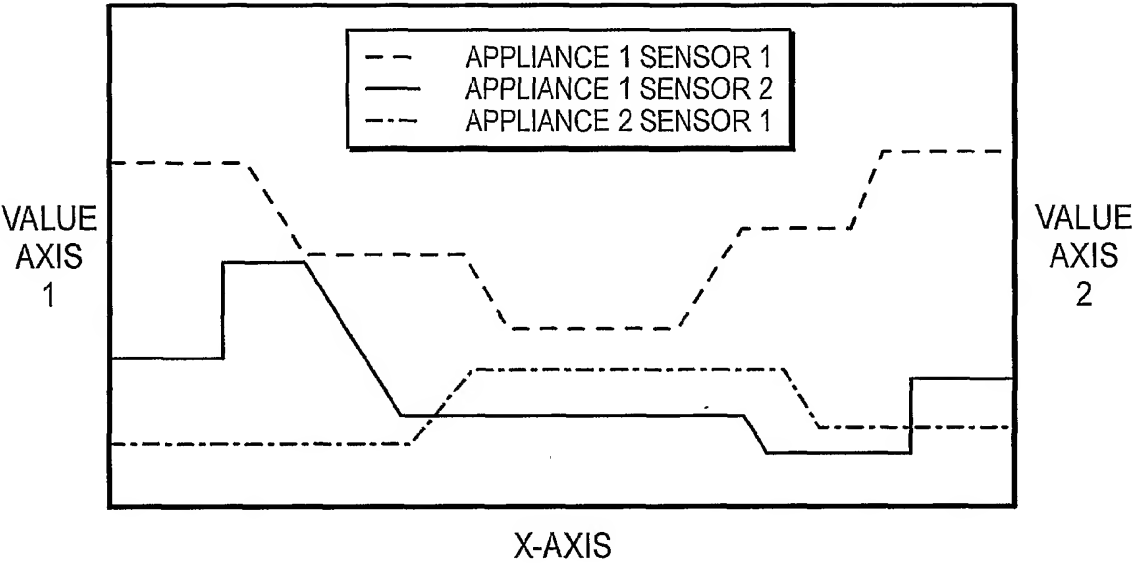


FIG. 13A

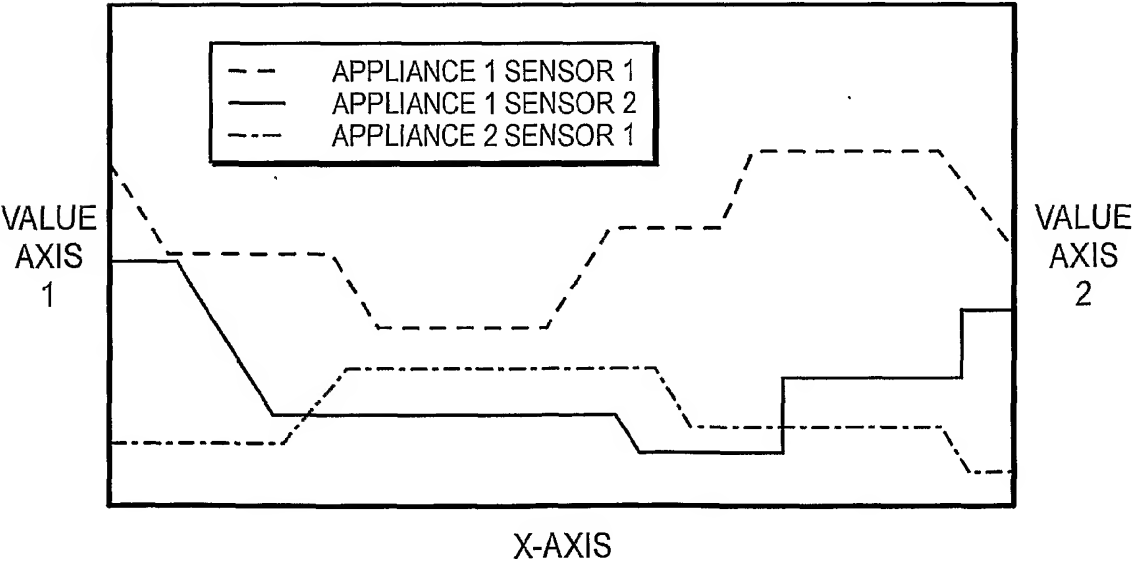


FIG. 13B

15/16

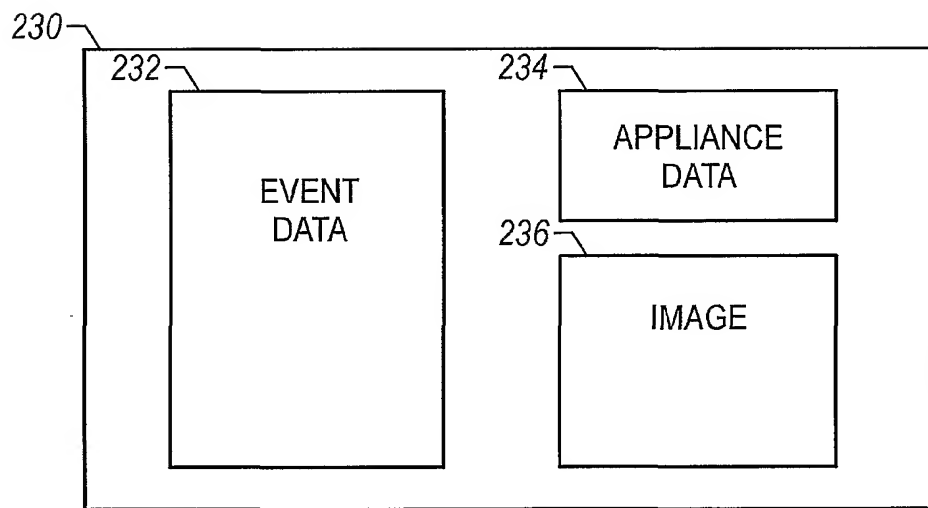


FIG. 14

16/16

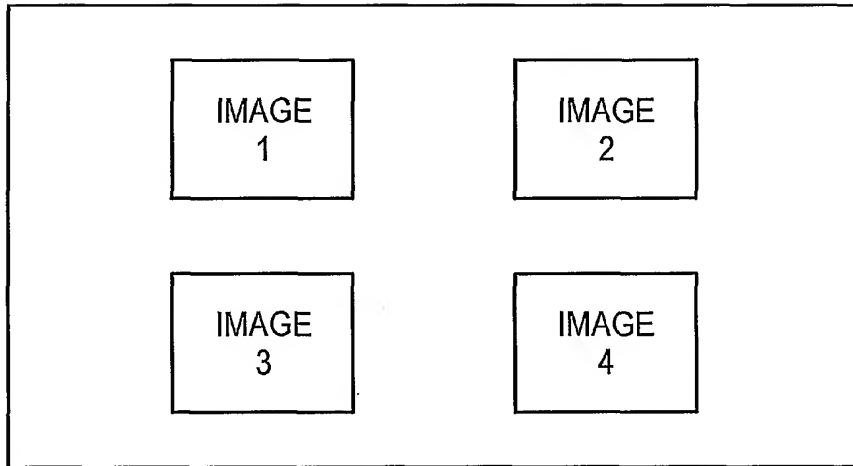


FIG. 15A

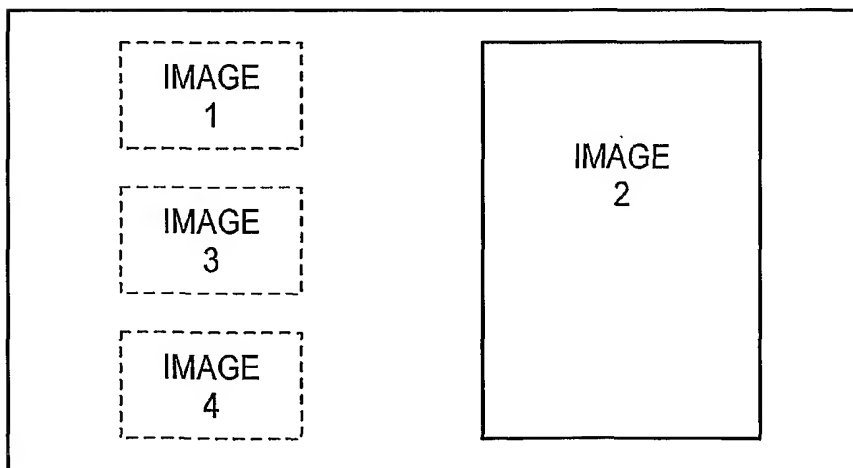


FIG. 15B

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/09178

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 15/173

US CL : 709/224

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 709/224, 203, 220; 345/735, 736

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,057,834 A (PICKOVER) 02 May 2000 (02.05.2000), col. 5, line 18 - col. 8, line 56.	1-49
Y	US 6,167,406 A (HOSKINS et al.) 26 December 2000 (26.12.2000), col. 34, line 54 - col. 37, line 15 and col. 51, line 25 - col. 55, line 28.	1-49
A	US 6,001,065 A (DEVITO) 14 December 1999 (14.12.1999), col. 2, line 6 - col. 3, line 16.	1, 17, 33
A	US 6,052,750 A (LEA) 18 April 2000 (18.04.2000), see entire document.	1, 17, 33
A	US 6,160,926 A (DOW et al.) 12 December 2000 (12.12.2000), col. 6, line 32 - col. 7, line 55.	1, 17, 33

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 26 July 2002 (26.07.2002)	Date of mailing of the international search report 04 SEP 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Jason Cardone <i>Peggy Hamod</i> Telephone No. (703) 305-3900

**INTERNATIONAL SEARCH REPORT**

PCT/US02/09178

**Continuation of B. FIELDS SEARCHED Item 3:**

STN

search terms: icon, plot, sensor, time sequence, manage, admin